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THE

STUDENT'S SURGERY.

A

MULTUM IN PARVO.

BY

FREDERICK JAMES GANT, F.R.C.S.,

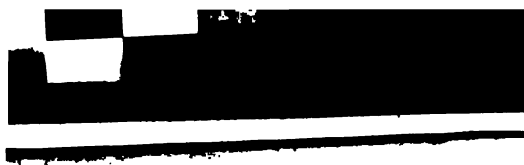
SENIOR SURGEON TO THE ROYAL FREE HOSPITAL.



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THE STUDENT'S SURGERY.

GENERAL PATHOLOGY AND SURGERY.

DISEASES OF NUTRITION.

CHAPTER I.

INFLAMMATION.

Surgery is that primary division of Medicine which has for its object the cure or the relief of morbid conditions of the body, in a corresponding division of Pathology. But the line of separation is arbitrary, conventional, and indefinite.

Firstly, as to the nature of the morbid conditions, or Surgical Pathology. All injuries, malformations, and deformities, congenital and acquired, and all diseases affecting external parts, are usually allotted to Surgery.

Secondly, in respect to the kind of Treatment, or the means of cure or relief. Surgery comprises all operations effected by instruments, manipulative procedures, and the employment of mechanical appliances; but it also has recourse to the administration of medicinal agents, and to hygienic measures.

As general conditions of Diseases—Inflammation, Morbid Growths or Tumours, and Degenerations, may be referred to aberrant modifications of Nutrition—in the part affected; namely, to Accelerated, to Reproductive, and to Declining Nutrition of the textural elements; while Ulceration, and Gangrene or Mortification, represent textural Death.

Inflammation.—The Pathology of Inflammation, or the nature of this morbid condition in the nutrition of a part, is best illustrated, when some external part is affected, as when induced by a burn of the hand—just reddening the skin. The changes are partly *textural*, and partly

vascular, with regard to the circulation of the blood, and the state of the blood-vessels, in the skin inflamed.

Inflammation may be *defined* to be a local modification of Nutrition; consisting, essentially, in an increased textural production and destruction of texture, and *acceleration*, therefore, of the nutritive process—by the effusion of liquor sanguinis, and emigration of the pale corpuscles of the blood through the walls of the capillary blood-vessels; with accumulation of the *débris* of the textures involved—consequent on the defective nutritive maintenance of the tissue-elements, their (fatty) degeneration and disintegration, or textural death. In connection with this twofold process of accelerated nutrition and death of texture, the local circulation of blood, and the containing vessels, undergo certain changes; in a general *dilatation* of all the vessels—capillary, arterial, and venous; with a central focus of stagnant blood (*stasis*), a surrounding zone of slow movement (*congestion*), and a circumferential area of rapid movement (*determination*).

Determination of blood is produced by an impression received by the centripetal nerves of the part injured, or otherwise subject to abnormal stimulus, and which is reflected by the vaso-motor centre through the centrifugal nerves to the vessels. But stimulation of the *vessels* has also a direct influence in causing determination of blood to the part. Subsequently the vessels having undergone dilatation, they become lengthened and tortuous, with fusiform enlargements, resulting in a paralysed state from over stimulation—especially in more established inflammation. This is accompanied with *congestion* or the accumulation of blood within the dilated capillaries. They are crammed with blood-corpuscles, the red being more central, the pale corpuscles clinging to the walls of the vessels—probably without any increased production of these corpuscles.

But the pale corpuscles of the blood, or *leucocytes*, *emigrate* through the walls of the capillary vessels; their transportation taking place in virtue of their *protoplasmic* activity; whereby, embedding themselves in the wall of the vessel, they assume a pyriform shape, and work their way through the wall, becoming detached, their passage is completed, and the corpuscles, which have thus emigrated from within, are each free outside the vessel. The red corpuscles may emigrate in like manner. The capillary walls also possess the contractile power of protoplasm, as evinced in the ramifying formation of new vessels. But emigration, as the mode of cell-production in inflammation, is probably accompanied with cell-proliferation in the connective tissue, which normally abounds with corpuscles; they rapidly multiply by endogenous development; textural productiveness thus contributing more or less largely to the increment of cell-infiltration of the part. Coincident with both sources of cell-production, effusion of the liquor sanguinis takes place, further increasing this surcharge of the textures.

When the Products predominate, the process of Inflammation issues in "Effusion," or with a superabundance of cell-product, in the formation of Pus; "Suppuration" signifying a diffused infiltration of leucocytes, or their circumscribed accumulation as an "Abscess;" when destruction of texture prevails, this issue in the form of molecular disintegration, is known as "Ulceration;" in the death of some visible portion of soft texture, the termination is named "Gangrene" or sloughing—Mortifica-

thus denoted, being spoken of as Necrosis, with regard to the bone.

and death are thus together busily at work in the process of action; each contending for victory in the part which exhibits the conflict. Thus, the hand—inflamed from the irritation of a burn, purpurate, or slough, or both results may ensue, and the bones necrosed.

is.—The local signs of inflammation are four: redness, heat, and pain, accompanied with some functional disturbance, or loss of power in the part affected.

ness—produced by the determination of arterial blood, and by constriction of the vessels, will be proportionate to the vascularity of the part; but the redness may be increased by infiltration of the part with colouring matter from disintegration of the red corpuscles. In acute inflammation, a florid hue, may assume various shades: in acute inflammation—scarlet; in chronic—darker, or a purple tint; lividity, deepening to blackness, when gangrene supervenes. Various other colours are not infrequently seen: brownish lividity—in phlegmonous erysipelas; a yellowish—jaundice; a copper colour—in syphilitic inflammation. Different degrees of redness are presented, according to the anatomical arrangement of the capillaries in the part; commonly—a uniform blush; punctiform, arborescent, maculiform or spotted redness, are also met with. In some cases, circumscribed, and diffused, redness; the one in phlegmonous inflammation, the other in erysipelatous. Of course, the redness from hyperæmia may be overshadowed, or rendered invisible by healthy textures, or by seated inflammation—as in periostitis, and osteitis.

Inflammatory redness must be distinguished from hæmorrhagic discoloration—interstitial extravasation of blood, in the form of spots or patches; although the two are sometimes associated. Pressure with the finger will disperse the former, not the latter. Redness, from the formation of new vessels, is not an early condition, but may be present on inflammation, in the process of repair after an injury.

Heat—arising from inflammation, is due to the determination of arterial blood, and, therefore, will be more perceptible in a highly vascular part, than in the skin, say of the hand, inflamed, reddened, and heated. It would appear to be a *local production* of heat, in the focus of inflammation; for the arterial blood supplied to the part, is not so hot as

the blood in the outflow of venous blood, is warmer than the arterial blood.

The cause of this increment of heat is unknown. Deep-seated inflammation will be attended with a less perceptible increase of heat; but, like redness, it becomes a less marked sign of inflammation.

Swelling—is the expression of effusion from the engorged vessels, and the accumulation of leucocytes from emigration. Later on, hæmorrhagic extravasation, sometimes occurring, as the weakened vessels burst, may add to the swollen state of the part; liquor sanguinis, serum, and blood-staining extravasation, commingling, and infiltrating the tissues with a swelling, *circumscribed* or *diffused*. Loose cellular tissue, or a cavity such as a serous or synovial membranous sac, will readily accommodate these products. Thus the size, shape, and extent of the resulting swelling will vary, according to the part affected. Local affections of an inflammatory character, such as erysipelas, and

synovitis—as of the knee-joint, swelling is a more conspicuous feature than even redness; and as a sign of inflammation is always more or less perceptible; excepting in internal inflammation, as of the lungs, liver, or kidneys, although parenchymatous organs may allow of a considerable amount of enlargement, from the interstitial accumulation of products. But, under an unyielding fascia, or in the substance of bone, inflammatory swelling becomes less appreciable.

Pain—a subjective sign, does not offer the objective character of redness, heat, and swelling, in evidence of inflammation. Exalted sensibility, tenderness, and then pain, is induced by the influence of the blood determined to the part, this hyperæmia being increased in parts which are naturally highly vascular; while the proportionate endowment of sensory nerves—the natural sensitiveness of the skin, for example—will augment the suffering. But, the *tension*, coincident with swelling—according to the accommodation afforded for effusion, is also a great factor, in the pain of inflammation. The character, as well as the degree of pain, is equally diversified. A burning pain—in erysipelas, formerly called St. Anthony's fire; a scalding pain—in some cases of ulcerated cancer; a dull, aching pain—in chronic rheumatism, and lumbago; the wrenching pain of a gouty toe; a burning pain—in abscess bound down by fascia, or forming within bone; while a *throbbing* pain, is the familiar sign of approaching suppuration in any part. Organs of special sense, not only become painful, their functions become painfully disordered; the eye, intolerant of light—in ophthalmia; the ear, of sound—in otitis.

Reflected pains,—affecting parts distant from the seat of inflammation, are not uncommon symptoms of diagnostic value in determining the remote source of irritation. Thus, pain on the inner side of the knee is not unfrequently symptomatic of hip-joint inflammation. The Student will here be called upon to apply his knowledge of anatomy—with regard to the relation of parts through the agency of nerve-supply, in this, and many similar cases.

As a local modification of nutrition, the textural and vascular changes give rise to a constitutional or general disorder of the system—known as Inflammatory Fever. This is only one expression of a general law in Pathology—the “Local Origin of Constitutional Disease.” On the other hand, an equally general and most important law is—“the Constitutional Origin of Local Disease;” of which we shall see abundant illustration in the Local forms of Scrofula and Syphilis.

Constitutional Symptoms.—**INFLAMMATORY FEVER.**—The phenomena of this fever are briefly these:—The heart's action is excited, the pulse becoming more forcible and frequent than usual, and in some cases less compressible, while the temperature rises, perhaps to 10° F. above the normal heat of the blood,—as determined by the *clinical* thermometer placed within the axilla or the mouth of the patient, for two or three minutes; the skin is dry and hot, alternating with chilliness or even shivering, the urine scanty and high-coloured, the tongue dry and furred, the bowels are probably constipated, and the feces dry and hard; thirst and inappetency, weakness with general nervous excitement,—restlessness, sleeplessness, or delirium, and hurried respiration, are also primary phenomena. Thus, the vascular, secretory, and nervous systems, are together engaged in a constitutional disorder—symptomatic of the local inflammation, and

EXTERNAL causes of inflammation are manifold, but they may be comprehended under four heads:—(1) Mechanical injury or irritations, as wounds, fractures, dislocations; or foreign bodies, introduced into the system, as grit, portions of clothing, a splinter of wood, a bullet, &c.; (2) Heat and Cold; (3) Chemical irritants, which decompose or kill living animal matter, as strong acids, alkalis, chloride of zinc, and other escharotics; (4) Vital irritants, as animal and vegetable poisonous matters, and some mineral poisons; as the fumes of noxious animals and plants, cantharides, mustard, capsicum, arsenic, &c.

INTERNAL causes may be either of an exciting character, in having a direct action; or predisposing in their operation.

Exciting internal causes comprise extravasated blood, dead textures, morbid products, organized and unorganized.

Predisposing internal causes include all those conditions of the system which diminish the vitality of the blood, and the loss of nerve-influence, which incline to inflammation. The body is thus rendered susceptible to the action of exciting causes.

The body, in a devitalized state, and ready to die under the action of morbid humors or depressors, is prone to inflammation; and thus a comparatively-nourished part, which has been subject to former injury or is ever liable to an inflammatory attack, when this "weak part" is assailed by some slight external cause—as when an old cicatrix, or a joint, is exposed to cold or heat. But tissues whose reproductive power is greatest, and which are commonly also most vascular, are most disposed to inflammation; as, for example, the skin compared with fibrous structures; or tissues whose productive power is temporarily increased during the growth of the body in childhood and youth. The vascular organs are similarly inclined; the lungs, for example, as with most other organs. On the other hand, a deficient supply of blood to a part inclines to inflammation by textural starvation; as in senile gangrene.

The condition of the blood is specially influential; poorness of blood—

least some such inflammatory affections are natural efforts to eliminate the poisonous matter from the system. Thence the predisposing influence of constitutional conditions generally, most of which are blood diseases manifested by various local inflammations, and ever ready to recur; as secondary syphilitic diseases of the skin and other parts, scrofulous affections of the bones, skin, and other textures. Other blood conditions predispose, as unquestionably, to local inflammations; but they require for their development the co-operation of external exciting causes—*contagious* matters—in each case peculiar, relatively to the special condition of blood, which is thereby brought into action. All the infectious and eruptive fevers are of this kind.

Septic and Infective Inflammation.—Organic matter, such as blood, pus, or albuminous serum, is prone to putrefaction, or septic decomposition, under the influence of atmospheric air and warmth; when this septic change is associated with inflammation, the concurrence may be named—septic inflammation; and septic matter entering the circulation by absorption, the inflammation is thus also infective of the whole body.

Predisposition through the influence of the *nervous system* is evoked by nerve injuries, the operation of which in producing peripheral inflammation is thus generalized by Simon:—A part deprived of sensibility becomes specially incapable of protecting itself against mechanical and chemical irritants, and accordingly inflames—*e.g.* the urinary bladder, subject to the action of retained urine, in paralysis. A part injured in respect of its innervation, is likely to suffer some circulatory disorder, with corresponding disturbance of natural temperature, and proneness to inflammation.

Course and Terminations.—Inflammation may proceed to either of four Terminations: Resolution, or disappearance; Effusion, or lymph-production; Suppuration, or pus-formation; Ulceration and Mortification, or death of texture.

(i.) **RESOLUTION.**—Inflammation may subside and terminate without any permanent structural result. This is resolution; a termination of inflammation by the concurrent cessation of all the elements of this process; and consequently, the cessation of all its local and constitutional manifestations. The redness fades away, the part recovers its healthy temperature, slight swelling if perceptible subsides, and exalted sensibility or pain ceases; while any inflammatory fever passes off.

(ii.) **PRODUCTIVENESS** may predominate; then, Inflammation proceeds to Effusion, or, perhaps, Suppuration—an increase of new material in the part, beyond the small proportion which necessarily attends inflammation.

Products of Inflammation and their Development.—**EFFUSION.**

—(1.) *Coagulable lymph* is more or less tenacious and at first transparent, it acquires a slightly opaque yellow colour. It is produced in the minute villi. This appearance is best seen on free surfaces which are not subject to motion or pressure; as between convolutions of the lungs in peritonitis, between the lobes of the lungs in pleurisy, and at the base of the heart in pericarditis. But wherever serous surfaces are in contact and play upon each other, the ductile lymph is drawn into thin plates, or plastered into films; as on free portions of the pericardium and on the parietal aspect of the intestines.

Coagulation having taken place, coagulated lymph is somewhat solid, though still retaining its tenacity and opaquish yellow colour. Its organization, in this its simplest condition of structure, is that of fine filaments, interwoven in various directions; as in the buffy coat of the blood. These filaments are formed apparently by the linear union of molecules, and they vary from $\frac{1}{10000}$ to $\frac{1}{100000}$ of an inch in diameter.

Cells or corpuscles appear in coagulable lymph, and are found interspersed among the molecular formed filaments, in coagulated lymph. Most probably, they are altered white corpuscles of the blood, which have emigrated; or, they may be due to proliferation of the nucleated cells in the tissue of the inflamed part.

Cells of this kind undergo self-development. By elongation, they assume an oat-shape; prolonged yet further in opposite directions, they are attenuated into filaments,—forming fibre-cells. Thence is produced *fibro-cellular*, or *connective*, tissue, generally the highest state of organization of inflammatory effusion.

Blood-vessels are found in organized inflammatory lymph, and possibly in coagulated lymph, but they do not appear to be formed in it; they project into the new tissue from the structure on, or in, which it is placed. The vessels are formed by the same process of sprouting, coalescence, and construction of loops, as in granulations. Lymphatics were discovered by Schroeder Van der Kolk in false membranes. Nerves have been twice seen by Virchow in adhesions; one of the pleura; the other of the peritoneum, between the liver and diaphragm.

False Membranes are formed on the inner or free surface of serous and of mucous membranes; as in pleurisy, pericarditis, and peritonitis; in croup, and dysentery. Such membranes consist of inflammatory lymph, which has passed through more or less development; and on serous surfaces, it may reach the state of organization just described, that of fibro-cellular tissue, supplied perhaps abundantly with blood-vessels.

The physical characters of false membranes vary according to their more or less high degree of organization and vascularity; the membrane is either pliant and yielding, or tough and unyielding.

Adhesion is apt to take place when the opposed surfaces of a serous or synovial cavity lined with inflammatory lymph, meet together. Similar adhesion may take place in wounds, or under other circumstances. Any such result of inflammatory lymph-effusion is sometimes referred to *adhesive inflammation*.

Other and more highly developed tissues are reproduced. They are, generally, allied in structure to the tissues adjoining, or which they substitute.

All these new tissues are subject—like their normal prototypes—to diseases, e.g. to inflammation, and growths, such as cancer.

Lymph-effusion may undergo *absorption*; or, if persistent, its operation may be either destructive, or reparative and constructive, and accordingly unfavourable or favourable to the function of the organ or texture thus affected.

The *reparative* power of adhesive inflammation is manifested by the healing of incised wounds in those cases where the effusion of lymph is induced by inflammatory hyperæmia. The repair of simple fracture and of simple dislocation, when reduced, is an analogous process, and com-

menced probably by inflammatory hyperæmia consequent on the injury. So, also, wounded arteries are permanently closed by adhesion of an inflammatory character in some cases; and the healing of ligatured arteries is certainly effected by adhesive inflammation, which seals the divided coats of the vessel above and below the line of ligature. Penetrating wounds of the thorax and abdomen, implicating the viscera, afford ample and varied evidence of the reparative power of adhesive inflammation. Wounds of the lung are healed by adhesion of the pulmonary pleura consequent on inflammation. Wounds of the abdominal viscera are healed in like manner wherever the peritoneal investment extends; and the visceral reflexion of the peritoneum is very apt to adhere to the parietal reflexion of this membrane opposite the external wound. In certain cases the peritoneum is purposely injured by the surgeon, so as to establish adhesive inflammation. This constitutes the radical cure of hydrocele and that of hernia.

(2.) *Pus* is a fluid having peculiar physical characters; an opaque greenish-yellow colour, diffuent or creamy consistence, faint odour, and an average specific gravity of 1030, but varying considerably from 1020 to 1040. All the characters of healthy pus differ considerably in the many diseased states of this product.

This fluid consists of a serum in which are suspended an innumerable multitude of corpuscles. They are spherical, somewhat granular-looking cells, from $\frac{1}{200}$ to $\frac{1}{300}$ of a line in diameter; and consisting of a cell-membrane, enclosing granular or molecular matter, and a nucleus situated, generally, on the interior of the cell wall and adherent. It varies in size from $\frac{1}{200}$ to $\frac{1}{400}$ of a line across, and consists of two, three, or four granules aggregated together. These secondary nuclei are round, oval, sometimes elliptical. The whole cell,—its membrane, and contained molecular matter and compound nucleus, are albuminous.

Pus-serum is a clear, colourless, or very faintly yellow fluid, having a weak alkaline reaction, and coagulating by heat into a dense white mass. Albumen is its chief constituent, in proportion from 1.2 to 3.7%. Fatty matter is extracted by ether, and it consists of olein, margarin, oleic and margaric acids, and cholesterin. Mucin, pyin, casein, chondrin, gluten, and leucine, are occasional constituents. The solid constituents of this serum range from 14 to 16%, of which from 5 to 6% are mineral, and the soluble salts are to the insoluble as 8 to 1. Of the former, chloride of sodium is most abundant, being three times more so than in the serum of blood. The soluble phosphates range from 3 to 10%. The insoluble salts are phosphates of lime and magnesia, with a little sulphate of lime and peroxide of iron.

Pus is seldom found pure, but associated with various ingredients, the *débris* of surrounding textures, and mixed with secretions. Healthy or laudable pus may thus become serous, mucous, sanguineous, strumous, cancerous, etc. Or pus may be specific; as the syphilitic pus, vaccine matter, pus of porrigo, of glanders, etc.

Exudation-corpuscles are round or irregular little masses, having a mulberry-looking appearance, under the microscope. Their size $\frac{1}{60}$ to $\frac{1}{70}$ of an inch in diameter. They consist of granules together, and sometimes enclosed in a cell-membrane; hence called also compound granular corpuscles. Within each of these

corpuscles is seen a round transparent nucleus, varying in size from $\frac{1}{5000}$ to $\frac{1}{1000}$ of an inch in diameter. The granules vary from $\frac{1}{10000}$ to $\frac{1}{8000}$ of an inch. They are fatty. Acetic acid does not affect the cells or masses; but they dissolve immediately in ether, and disintegrate under the influence of potash or ammonia. Exudation-corpuscles result from fatty degeneration of pus-corpuscles, or of other cells, and are not peculiar to inflammation.

The products of Inflammation are usually found associated; but one or other so far predominates, in different textures or organs, as to give its own structural character to the deposit; in cellular texture and parenchymatous organs, as the lungs, the product is chiefly granular matter and exudation-corpuscles; in or on mucous membranes, chiefly pus; on serous membranes, chiefly coagulable lymph.

Degeneration of Inflammatory Products.—In their highest degree of development, the Products of Inflammation are of lower organization than most normal tissues, and being also of low vitality, they may fall into an inert and wasted or atrophied condition; or retrogressive changes take place, in the form of Degeneration,—fatty, pigmental, or calcareous.

Signs of Effusion and of Suppuration.—Inflammatory Effusion is attended with swelling, in consequence of the progressive accumulation of the products of effusion.

Suppuration is announced by a throbbing or pulsating pain, increased heat, redness, and swelling. But proceeding as these signs do from increased determination of blood, a condition not essential to suppuration—they are not invariably present, or followed by suppuration; the inconsistency, in either respect, depending on the kind of texture in which inflammation takes place. In any unyielding texture, inflammation is accompanied with a throbbing pain, without suppuration necessarily ensuing; toothache being a familiar example. In a loose parenchymatous texture, which more freely admits the afflux of blood, extensive suppuration may have supervened, without any previous throbbing; as in the cellular texture of the ischio-rectal fossa. On the other hand, with regard to increased swelling; in loose cellular texture, considerable effusion and swelling may have taken place without suppuration ensuing; while, in an unyielding texture, an abscess forms, without any previous increase of swelling.

Abscess.—Lymph may become deposited so abundantly around the focus of suppuration, as to effectually circumscribe and imprison the pus. The textures, thus encompassed, die, disintegrate, dissolve, and are removed by absorption, leaving the pus, more or less pure, in their place. An abscess is formed; which may be named *acute* or *subacute*, with reference to its more or less speedy formation; sometimes also termed a *hot*, or a *phlegmonous* abscess, as having regard to the sthenic character of the inflammation, or the firmly circumscribed boundary of solid lymph. A common boil is a good example of this form of abscess. It is the opposite condition of what has been termed *diffuse* abscess, which is nothing more than diffused suppuration. The circumferential lymph of this pus-containing cavity becomes highly organized, by the development of the capillary blood-vessels, having a looped arrangement; and it assumes somewhat the structure and characters of mucous membrane, and acquires a secretory power. It becomes pus-forming, as well as pus-containing;

it is a *pyogenic* membrane; and as it absorbs old pus, as well as secretes new matter, the abscess is gradually concocted or ripened.

The *Signs* are now those of abscess. The throbbing pain, heat, and redness, all the signs of previous active hyperæmia, are mitigated by the yielding resistance of pus as compared with that of partially solid lymph; unless the matter be confined under any unyielding texture, such as a fascia, or within bone. But a fluid and fluctuating, elastic swelling is presented, rather than one having the solidity of coagulated lymph, or the softness of pus diffused. To detect the presence of matter, a gentle tapping pressure with one or two fingers may suffice to convey the sensation of fluid; or, by this digitation on one side of the abscess, while the fingers of the other hand are lightly applied to the opposite side, a fluid stroke, or a wave-motion—fluctuation—will be more or less distinctly felt. According to the depth of the matter, so must these manipulations vary in degree; but the sense of touch varies also in different individuals, and the Student should lose no opportunity of gaining the "*tactus eruditus*."

Pyogenic membrane may lose its functional power; then, pus-secretion failing, while absorption continues and prevails, the abscess dwindles and gradually disappears; or, retaining its power unimpaired, secretion and absorption are, perhaps, equally balanced, and the abscess remains stationary and becomes *chronic*. This form of abscess often occurs in the cellular texture, but usually in connection with dead bone—necrosis—or within the substance of a bone, as in the head of the tibia; and in the lymphatic glands or the salivary glands, chronic abscess is not uncommon; although in these parts, owing to the constitutional character of the suppuration, this abscess is usually named *scrofulous*. The *signs* are still those of abscess, as a fluid, fluctuating swelling; but the pain is less, unless maintained by some source of irritation, as in necrosis, and there is little heat, or redness. But the swelling has become more unlike that of an ordinary acute abscess, and, owing to the thickened induration, more resembles a solid tumour, for which a chronic abscess might be mistaken by an inexperienced surgeon.

Allied to the chronic abscess is the *congestive*, or *cold*, also named *lymphatic*, abscess; which occurs, sometimes, in the cellular texture or in the glands of debilitated subjects; the part suddenly falling into suppuration, as a thin bag of matter, without any notable symptoms of abscess. Thus, in the loose cellular texture of the thigh or axilla, or in the neck, a nearly painless and perhaps colourless swelling appears, and which freely fluctuates when examined. This swelling is often of large size, and may rapidly increase; tending to burrow beneath the integuments, and in the cellular planes between the muscles. For, unlike an ordinary chronic abscess, the circumscribing wall of fibrin always remains thin and ill-defined; but the contained matter is similar—a thin, sanious, opalescent, yellow fluid, consisting of serum, with broken-down pus-cells, in a state of fatty degeneration.

3.—In a variable period, usually before an abscess becomes absorption of the pyogenic membrane itself begins, under the constant fluid-pressure. And generally, in the direction of the abscess points; the circumferential tissues, degenerating, undergo absorption more readily, or yield more, in as the expanding force there gains advantage. A promi-

ars, tense, as with fluid; over which the skin assumes a with a shining or glazed aspect, while the cuticle cracks receding rings. Here fluctuation is most perceptible in the integument, which at length becomes relaxed. This tent, from a small point to an area the size of a shilling, the margin is usually circular and well defined. Soon a arates and pus escapes. Thus, also, in the case of mucous aperture is formed; but serous membrane yields with a n of the abscess is relieved, the prominent point and its of inflammation subside; and if the aperture be suffi- dependent, or made so, the matter is discharged or drains able lymph is effused instead, and forming granulations, rds the aperture, and gradually closes the cavity of the idual abscess is now a healing *ulcer*, and the process of mpleted in a period varying from, perhaps, twenty-four eeks, or months.

t be incomplete, the sac of the abscess is brought together ere, leaving intervening pus-producing cavities; a *multi-* is formed. Or, the cavity contracts into a long narrow ith a perfect pyogenic membrane throughout its course, obstinate indisposition to heal; a *fistula* is formed. It ent to distinguish a *sinus* by the absence of a pyogenic channel may be pus-discharging, from the burrowing of not pus-secreting, although having no disposition to close. ly said to be distinguished from fistula, chiefly, by its opening; a sinus being a long narrow, suppurating canal, lly or internally, and having little disposition to heal. nal is an *incomplete* fistula; as may be fistula in ano.

n abscess, after evacuation, acquires an unhealthy character, thout any tendency to heal. The sac secretes a fetid uced probably by the admission of air, or by some con- dler affecting the pyogenic membrane, and the production is delayed. Or, at a later period, when the abscess is alcer, it, like ulcers arising otherwise, may exhibit an osition to heal. From constitutional causes chiefly, this e irritable, inflamed, sloughing, or phagedænic.

translation signifies an extension from the seat of origin perhaps distant locality, where the abscess makes its y such extension is favoured by various circumstances: r with which pus produced in certain parts, finds its way by the comparative facility with which it travels to other progress of the abscess, allowing opportunity for its by special circumstances conducing, which are peculiar to ood example is *psaos* abscess, which, arising in connection es, travels down within the sheath of the *psaos* muscle, eath Poupart's ligament.

translation must not be confounded with *metastatic* or ss, consequent on pyemic infection.

f translated abscess are: a fluid, fluctuating swelling, like ary abscess; but its concomitant redness, heat, and pain, me degree of inflammation may ensue, from the weight of

pus on the most dependent part of the abscess, and pain also may be experienced, owing to pressure on nerves in the neighbourhood.

Fistula and Sinus.—The pathology of sinus and fistula has a wider significance than in relation only to abscess; for these passages may result from ulceration and sloughing, or from the imperfect healing of wounds. Generally, all these modes of formation depend on some local source of irritation; as a piece of dead bone, the escape of some secretion, as urine or feculent matter, and less frequently, bile, gastric juice, or saliva; and, the disturbing action of muscles in the neighbourhood of the part affected. Thus may be produced fistula in connection with necrosis or caries; perineal fistula, recto-vesical fistula, and vesico-vaginal fistula; fistula in ano; biliary, gastric, and salivary fistulae; fistula from the healing of wounds in the limbs.

The walls of a fistula are lined with a more or less complete pyogenic membrane, secreting an unhealthy purulent fluid, in varying quantity, mixed perhaps with some other secretion. According to their indisposition to heal, these passages are more or less hard—callous, as it is termed, with condensation of the surrounding cellular texture. On introducing a probe up such a passage, it is found to be but slightly sensitive, or ready to bleed. An opposite state may be met with; the passage feeling soft or spongy, acutely tender, and bleeding freely; so that even under gentle pressure, the probe may easily penetrate the wall of the passage, and get out of the track.

The orifices of a complete fistula are two—an external or integumental, and an internal, leading into an abscess, or into some mucous canal or cavity, as the urethra or the rectum. The external orifice presents certain varieties of appearance, which are practically important, as indicating the state of the fistula, or the presence of some source of irritation, local or constitutional. Thus, an inverted orifice, with a border of thickened and indurated integument, is connected with a callous and chronic condition of fistula; while an everted external orifice, presenting an out-crop of soft spongy granulations, or “proud-flesh,” may be connected with caries or necrosis, as the foreign body which maintains this indisposition of the fistula, or fistulae, to close. The discharge from a fistula, so long as the passage is indisposed to heal, is itself never of a healthy character; but it is less characteristic, contrasting only with healthy pus in being a thin, grumous, yellowish or reddish fluid, consisting of serum with broken-down pus-cells and blood-corpuscles.

Besides the ordinary conditions of fistulae, they are liable to assume the various diseased states of an ulcer, becoming irritable, inflamed, sloughy, or phagedenic. When manifesting a tendency to close, as a healing fistula, the pyogenic membrane, which had previously a mammillated or imperfectly granular surface, now forms healthy granulations, the passage begins to contract and get smaller; while the external orifice is no longer inverted or pouting, but is beset with small, florid granulations, followed by cicatrization. The discharge also assumes the existence and appearance of healthy pus.

Fever.—The constitutional disturbance or hectic fever accompanying suppuration and abscess, is characteristic. Commencing at a certain stage in the course of inflammation, the first symptoms are those of fever, with excitement. A sensation of chilliness or a shivering

ors—announce the one, while the other—nervous excitement—is ed by restlessness and sleeplessness, the pulse also retaining its icy, or rising in rapidity, although losing its force and hardness. At and flush of skin subside, a cold clammy sweat supervenes, the becomes pale, abundant, and deposits a pinkish sediment of lithates. tongue loses its brown fur, is white and pasty with a bright scarlet tip; appetite is very capricious, sometimes absent, with loathing of food and vomiting; while profuse watery diarrhoea succeeds to the previous action. Progressive emaciation and trembling weakness bespeak want of nutrition; and the general course of the symptoms at length marks the victory of exhaustion.

Hitherto this fever has been uninterruptedly continuous with that inflammation; but if it be prolonged, it acquires an intermittent character,—exhaustion prevailing, yet with recurring efforts of excitement, disorderly of the circulation, followed by increased secretions from the kidneys, and bowels.

The temperature in rigour rises always shortly before the commencement of an attack, and remains high for a varying period, commonly half an hour after the shivering terminates; then it subsides gradually down to the degree from which it rose, or even lower. This rise and fall of temperature is very characteristic of Hectic.

In the course of prolonged suppuration and Hectic, death may occur from the exhaustion consequent on long-continued purulent discharge, and a proportionate loss of albuminous matter; but, not unfrequently, the fatal issue may be referable rather to an insidious and latent degeneration of various internal organs. This degenerative transformation is, I believe, nearly always the amyloid, waxy, or lardaceous form of degeneration, and as the proper structural elements of the organ affected are gradually substituted by the amyloid matter, the degenerated organ undergoes considerable enlargement. The liver, spleen, kidneys, and nasal mucous membrane, are commonly the seat of this destructive process.

1.) DESTRUCTION of Texture, as the result of Inflammation, commences with mortification and ulceration. (See Terminations, p. 6.) Mortification, or the death of a part, receives different names according to the extent and recoverable, or total and irrecoverable, loss of vitality in the affected; the one condition being named *gangrene*, the other *slough*. Both these terms refer to death of the soft textures, and when this takes place to a limited extent and is accompanied with a partial separation from the living textures, it is termed *slough*, and the detached part is a *sloughing* of the part; when bone is affected, mortification is termed *osteonecrosis*, and the dead portion, a *sequestrum*, and its separation, *sequestration*. This latter term is sometimes restricted to the detachment of an external portion of the bone, in the shape of a thin scale or plate. Ulceration may be conveniently described first, as being in its nature introductory to mortification.

The phenomena of ulceration generally, are these:—A portion of the tissue having become inflamed from any cause, after a few days a piece separates and comes away, leaving a corresponding loss of substance—a chasm, from which a discharge, variable in kind and quantity, issues. Thus, then, the skin, or mucous membrane, with per-

haps the subjacent cellular tissue, has undergone a "solution of continuity," slowly, however, as contrasted with a wound, or other recent breach of texture, and an *ulcer* is formed. Its formation and extension constitute *ulceration*. When the destruction of textural elements is limited in depth to only the cuticle or epithelium, it may be distinguished so far as an excoriation or abrasion.

The proper discharge from an ulcer—the product of ulceration, not of a granulating sore—is *ichor*. It is a thin sanious fluid, colourless or slightly yellow, structureless, but mixed with exudation, pus, and blood corpuscles, and with the *débris* of the ulcerating textures. Hence its variable appearance. Its essential chemical composition is unknown. Ichor corrodes the living tissues, and is thus distinguished from pus, which it often resembles in appearance. Owing to its corrosive nature, ichor may operate as a solvent of the already degenerated texture-elements, while as an irritant, by provoking inflammation of the surrounding textures, they fall into degenerative disintegration. Thus also it maintains and extends ulceration.

Mortification is only another mode in which any part of the body may die; a reciprocal relation subsisting between this process of destruction and ulceration. They differ in degree, but are one in kind. Ulceration may be exaggerated into mortification, and this may subside into that. Both are convertible by different gradations of the same process of destruction. Thus, now and then during ulceration, some temporary cause may accelerate the inflammation; a larger portion of tissue undergoes degeneration and dies than can disappear as discharge, and this portion of dead tissues becomes visible in the shape of slough, instead of having been removed imperceptibly by molecular disintegration and liquefaction, aided by the corrosive action of the ichorous secretion.

The *Signs* of gangrenous inflammation are—acute burning pain, instead of the throbbing of approaching suppuration. The redness deepens into purple, and thence to a livid hue, a change of colour due to stagnation of the blood in the dying part. The swelling, moreover, is peculiar, for here the textures are disintegrating and softening, macerated also by the effused fluid in which they are soaked. Hence a flabby softness is presented. Phlegmonous erysipelas, as it advances, well illustrates these signs of gangrenous inflammation.

Fever.—From this condition of local disorganization the *constitutional* disorder at once commences. More insidious, its symptoms resemble those of pyæmia, although differing in degree. A wild, apprehensive look, with great restlessness, are conspicuous; the features and manner at length become more composed, and the face assumes a pallid hue. The skin over the whole body and the tunica conjunctivæ sometimes a peculiar yellow colour. Utter prostration of mind and of its power gradually supervenes, and a quivering subsultus tendens—the pulse beats very feebly, rapidly, and irregularly, feeling like a drawn under the finger. The secretions are soon perverted; first hot and dry, is now bathed with a cold, clammy sweat; etid and scanty, may be suppressed; a brown, rough, dry vomit accompanied with nausea and a putrid diarrhœa. As the powers of animal life fail, involuntary excito-motions predominate; convulsions shake the moribund body, while coma ends in death.

But the gangrene may cease to spread. The reddish-brown tint of the skin in advance of the dead part becomes brighter and more circumscribed. Shortly a white raised *line of demarcation* is seen in the living skin, immediately adjoining the dead portion. Soon this line melts away into a groove by ulceration; extending deeper, it forms a fissure, and successively passing down through tissue after tissue at length converges, and completely detaches the whole of the dead parts. While the living organism is thus separating itself from the slough, adhesive inflammation precedes the line or fissure of ulceration in its length and depth, sealing the blood-vessels, so as to exclude any further communication with the dead tissues, and prevent absorption of their *débris*. The typhoid type of fever passes off, and is exchanged for some degree of inflammatory fever, which accompanies the process of separation and detachment of slough.

Treatment of Inflammation, and its Consequences.—The removal of any exciting cause or causes in operation has reference to the various kinds of irritant matters—mechanical, chemical, and vital—that were enumerated among the “external” causes of inflammation; moreover, any constituent of the organism which has become a foreign body, and morbid products, which are more apt to assume that character. They are the “internal” exciting causes of inflammation.

Local Treatment.—(1.) **ACUTE INFLAMMATION.**—LOCAL remedial measures consist in rest of the part, and the application of cold, heat, or warmth, with moisture, as in the common bread-and-water poultice or moist spongio-piline epithem; in blood-letting by leeches or scarification, or an elevated position of the part inflamed; incisions, sufficient to relieve tension; antiseptic dressings; blisters, setons, issues; caustics, as caustic-potash, mineral acids, iodine, burning heat or the actual cautery, and other strong irritants; astringents, friction, pressure.

CONSTITUTIONAL or systemic measures include—blood-letting by venesection, purgatives, diaphoretics, diuretics, starvation and the antiphlogistic régime; antimony, opium, mercury; wine, brandy, ammonia, and other stimulants; cinchona bark, the mineral acids, and other tonics; cod-liver oil, nutritious diet.

Taking this list of remedial agents, some are of the most opposite character, but they may all be used appropriately, in the course of inflammation generally, and in the order enumerated.

1. *Rest.*—This element of remedial treatment has a most important relation, local and constitutional. Rest of the part undergoing inflammation will tend to arrest that process, by suspending the exercise of function, and the consequent nutritive changes, in the part affected; rest of body and mind is restorative, by suspending, in some degree, the functional activity of the nervous, the muscular, and the vascular systems, which are principally engaged in febrile disturbance, and the excitement of which reacts unfavourably on the inflamed part. Thus, an inflamed hand should be kept at rest by placing it in a sling, or supported on a pillow, or more absolute rest may be secured by the mechanical contrivance of a splint; while the repose of recumbency on a couch, the cessation of any mental exertion or emotional excitement, and the exclusion of talkative friends, of noise and light, or other impression on the senses—in short, of every source of disturbance to the patient—

constitute that general quietude which will be most favourable to recovery.

2. *Cold* is more efficacious in the early treatment of inflammation, and as affecting external parts of the body. It may be applied, according to the degree of cold required, by means of cold water or ice, or by an evaporating lotion of spirits of wine and water in various proportions. Lead lotion—the liquor plumbi diacetatis, a drachm or more to eight ounces of water—is another refrigerant, but far less serviceable. The application of cold externally will even reach an internal organ, as the brain in meningitis, through the interposed scalp and cranium; but in all such cases the more intense cold of pounded ice in a bladder is necessary to produce a beneficial effect.

3. *Heat*, moderate, with *moisture*, is preferable in those cases where cold is uncomfortable to the part, or occasions any shivering sensation. Moist warmth is more advantageous also when inflammation is established, the efficacy of cold as a textural depressor being restricted rather to incipient inflammation. Warmth and moisture are conveniently applied in the shape of a light, soft bread-and-water or linseed-meal poultice; or by means of spongio-piline soaked in warm water. The latter surpasses any kind of poultice, which is apt to dry, thus becoming an irritant, and is uncleanly. Spongio-piline is even more retentive of moisture than an equal substance of flannel, and more suitable, therefore, as an epithem.

Dry heat is sometimes substituted for warmth and moisture. Thus, cotton wool, applied warm, and covered with oiled silk, forms a convenient dry epithem; or by absorbing the perspiration, acts as a poultice. Hot flannels or bran-bags are similar appliances, which may be convenient according to circumstances.

4. *Blood-letting locally* is beneficial whenever it appears desirable to make a sudden, considerable, and direct impression on an inflamed part, as the eye in iritis. Leeches, scarification, or cupping are available for this purpose. Leeches can be applied to a part which is inaccessible to the cupping-glass, as the os uteri. But the drawing action of a cupping-glass, the pressure of the atmosphere being removed, penetrates to a greater depth than the abstraction of blood by leeches. Hence cupping is more suitable for inflammation of internal organs, as the kidneys when inflamed.

5. *Position*.—An elevated position of an inflamed part is equivalent to the local abstraction of blood. The determination of blood becomes diminished, and the return of blood facilitated; whereby the quantity in the part is greatly reduced. Elevation thus offers a resource which is a good substitute for, or a useful adjunct to, local blood-letting. Its efficacy is witnessed in the treatment of inflammation affecting different parts of the lower extremity; as in compound fracture of the leg, dislocation or disease of the knee-joint, and other morbid conditions. The relaxation of any muscles which, subject to spasm, would disturb the part inflamed, is another important consideration. This must be effected by *posture*.

Incisions may be resorted to for the *relief of tension*; this being effected by distension of the blood-vessels in the part inflamed, but by the serum effused. The incisions should be made in extent according as either condition of tension predominates. In erysipelas, both sources of tension are relieved by incisions

different parts of the skin, as the chief seat of vascular distension, and tending down to the subcellular texture, which is engorged with serum. poultice is applied, but *after* the cessation of hæmorrhage, lest more should be lost than would be desirable. If the bleeding return, the poultice must be removed, and strips of dry lint placed in the bottom of each division up to the surface, and a light pad over all, retained by a bandage; the limb or part in an elevated position. After a few hours, the bandage and pad may be removed, and a poultice re-applied, over the strips of lint, which should not be withdrawn until they separate with suppuration.

Antiseptic dressings are eligible in the treatment of inflammation, only when attended with an *open* surface. Their nature and modes of application are explained in the treatment of Wounds.

(2.) CHRONIC INFLAMMATION.—1. *Irritants*.—Blisters, in the form of ætharides plaster or the blistering fluid; rubefacients, as the mustard ointment; setons, issues; caustics, as nitrate of silver, potassa fusa; the mineral acids, iodine, mercury, tartar-emetic, croton oil, burning heat or the actual cautery, and other strong irritants, are remedial measures of more or less value in *chronic* forms of inflammation. Their intensity of action varies, but their kind of action is said to be counter-irritant or derivative from the inflamed part, by exciting inflammation in the neighbourhood of that part. This may be true in some cases. In other cases irritants have the opposite effect—they increase the inflammation in the part itself; either bringing it to a termination by resolution, or by promoting effusion and hurrying on the process of suppuration.

2. *Astringents* prove serviceable in a congestive, and often chronic state of inflammation; the capillary vessels being distended and obstructed. solution of nitrate of silver, or the sulphate of zinc—five or ten grains the ounce of distilled water—may then be used with great benefit, as in congestive conjunctivitis; and the relief afforded by an alum gargle in an inflamed sore-throat, is another illustration of astringent applications. Cold *ouches* probably act in like manner, by constringing the weakened and overloaded vessels of a part affected with chronic inflammation; as the nits, for example.

3. *Friction* offers another resource, in a similar state of inflammation; the act of rubbing with the hand, or shampooing, not only tending to unload the vessels, but also operating as a stimulant, to promote the circulation in the part. Hence friction may be aided by the use of some stimulating liniment or embrocation, as of camphor and olive oil.

4. *Pressure* has the beneficial effect of supporting the vessels when in a relaxed state; but this means may also be combined with a stimulant application. Thus, the support of a bandage, or of simple strapping with tape-plaster spread on leather, may be exchanged for the emplastrum ammoniaci cum hydrargyro; and either mode of treatment is often very successful in chronic inflammatory affections of the joints, breast, or scrotum.

Constitutional Treatment.—(1) ACUTE INFLAMMATION.—1. *Systemic blood-letting*, by venesection. This mode of depletion has fallen early into disuse, in the treatment of inflammation.

But two conditions—forcible action of the heart, and vascular tension, the latter being denoted by a hard pulse—are alike diminished by general

bleeding; the pulse becoming weaker, slower, perhaps more regular, and softer.

The propriety of having recourse to this reducing measure should therefore be determined and regulated by reference to the state of the general circulation, as indicated by the characters of the pulse in respect to its force and hardness.

The effects of blood-letting are more than momentary. This should always be remembered in considering the necessity for producing a powerful and persistent impression on the general circulation. Such impression can be made in either of two ways; the one or the other having a salutary tendency, according to the previous duration of the inflammation.

Recent inflammation may be arrested by the loss of a moderate quantity of blood, suddenly—i.e. through a large orifice or from both arms at the same time, and the patient being placed in the sitting posture, so as to induce syncope.

Inflammation of a few days' duration will be more surely brought to a termination by the loss of a larger quantity of blood, gradually; the bandage above the orifice in the vein being loosened, and the patient placed in the recumbent position to avert the tendency to syncope. Or venesection may be repeated from time to time, according to the symptoms; thereby renewing and further maintaining the impression originally made on the circulation.

The advantage of gradual over sudden loss of blood, in inflammation of some duration, is evinced by the fact that, if the first impression be thus maintained, it is found unnecessary to repeat it.

Local blood-letting, by means of leeches, or cupping, will prove sufficient afterwards, in most cases; or, in the first instance, by directly affecting the inflamed part without powerfully and persistently influencing the system. It should never be forgotten, that the permanency of systemic impression is directly proportionate to the quantity of blood lost. Nutrition is reduced throughout the body, and any process of reparation may fail. Probably the vital injury of excessive blood-letting or of such hæmorrhage accidentally, is never quite recovered from.

Venesection or *Phlebotomy* might be effected by opening any vein of sufficient size to admit of a free flow of blood; but the vein usually selected is one at the bend of the elbow,—the median basilic in particular; or the external jugular in the neck, will be preferable in exceptional cases. This little operation is described in any manual on Minor Surgery.

Arteriotomy may be performed as an occasional substitute for phlebotomy, and principally in affections of the head or of the eye. The temporal artery is the vessel selected, and its anterior branch, as being superficial, and well supported by the temporal fascia.

2. *Purgatives* not only remove feculent matter, which would otherwise be a source of irritation affecting also a large extent of intestinal mucous membrane, but their operation is depletory by inducing the discharge of serum from the blood. Purgatives are, therefore, a useful ad-

even a substitute for, general blood-letting, in relieving . Different kinds of purgatives appear to act on different intestinal tract; and hence a combination of these are more efficient than any one alone. Salts and senna, are familiar examples of such combinations.

removing irritant matter, and having a depletory and an operation, purgatives are said to have a derivative action, by inducing hyperæmia of the intestinal mucous membrane. They are supposed to antagonize inflammation of the brain.

But it is a kind of action which prohibits the continuedatives, lest intestinal inflammation be superinduced.

Derivative operation of mercury is referable to its agency in prosecretion of bile,—itself a natural purgative. Besides, how-

ever, this effect, the "cholagogue" action produced by larger doses is equivalent to general blood-letting as a depletory, and as an excretory remedy; for the copious spinach-like evacuated are equally effectual in reducing vascular tension, and are non-rementitious, without unnecessarily diminishing the quantity of circulation. Calomel, in doses of five, ten, or twenty grains, as occasion may require, is perhaps the best cholagogue.

Diaphoretics and diuretics, medicinal agents which increase or alter the action of the skin and kidneys, respectively, are purgatives in

effect. They are depletory, excretory, and derivative. Such is the action of the nitrate of potash, a diaphoretic, and the nitrate of potash, a diuretic. Administration constitutes what is more particularly designated

derivative treatment. A liberal allowance of water, soda-water, or

fluid, seems to favour the excretory operation of these probably by diluting, and, as it were, washing away effete

from the system. A cool, fresh atmosphere around the patient is an important adjunct to febrifuge treatment, in carrying off the

cremementitious emanations of febrility. Hence, the antiphlogistic of a well-ventilated apartment, the amount of clothing or

being regulated by the diaphoretic treatment; while cleanliness should be attended to, as subservient to atmospheric purity, and

to any irritation to an externally inflamed part.

Antiphlogistic is another kind of depletion, by withholding the supply

of blood. The "antiphlogistic regimen" is rather a negative than

positive regimen. Dietetically, it consists in abstinence from animal

stimulating drinks, and in the moderate use of bland fluids, as

tea, gruel, arrowroot.

Opium, as an internal remedy, most nearly resembles general

derivative. After a dose of, say, half a grain, repeated or increased to

two grains, every three hours, until vomiting occurs, the

circulation and secretions are very marked. At first, the

action is more rapid and feeble, it dwindles down to a fine thread.

After having occurred, the pulse loses its frequency, and perhaps

becomes, but acquires a peculiarly full and soft character; showing

that tension is overcome or relieved. Simultaneously, perspira-

tion and secretion of urine are notably increased; and liquid evacua-

tion of the bowels not frequently accompany this relaxation. The

muscles are flaccid and powerless. In short, the whole muscular

system and vascular, is relaxed; and a flux or flow takes place

from the secreting organs, which further reduces the vascular tension.

Inflammation is thus materially diminished.

Opium, Aconite, Belladonna, Veratrum Viride.—As belonging, with

to the class of sedatives, these additional medicinal agents may

occasionally be resorted to in the treatment of inflammation; but from their special operation in diminishing the heart's action, both in its force and frequency, such sedatives might be termed *cardiac depressants*. They may be administered sometimes as substitutes for antimony, or for blood-letting, in an early stage of acute inflammation, to arrest its progress before effusion has taken place; or the same agents sometimes prove beneficial in maintaining a depressing influence on the circulation.

6. *Opium* is of signal service in the treatment of inflammation. It seems to act partly like antimony and blood-letting by overcoming vascular tension, but opium has the advantage of also subduing nervous excitement. Its administration is, therefore, most appropriate when this is the predominant element in inflammatory fever; or, when, excitement of the circulation declining, that of the nervous system with general weakness becomes prominent. It is thus that opium proves so beneficial after severe injuries or surgical operations; where shock is followed by excessive reaction, or prostration with excitement prevails over or outlasts inflammatory fever.

In some cases, opium acts specially on the part injured or operated on, by subduing muscular movements, voluntary or involuntary, as by paralyzing the peristaltic movements of the intestine after the operation for strangulated hernia. It seems also to depress the textural activity of the inflamed part, and to influence, in some way, favourably, inflammation having an ulcerative or gangrenous tendency.

The chief disadvantages attending the use of opium are—the sickness it is apt to occasion at first, and constipation by its more continued use. The latter can be controlled or prevented by our next remedial measure, prescribed in combination with the opium.

7. *Mercury* counteracts the constipating tendency of opium, and this, in its turn, overrules the aperient action of mercury; either medicine checking the intestinal influence of the other. The combination generally employed is calomel and opium; in the proportion of from one grain to five of the former, with a quarter of a grain to one grain of the latter, given as a pill every four hours or so.

Until recently, it was unanimously held that mercury prevented or retarded the effusion of fibrin, and promoted its absorption.

Simon limits the agency of mercury by the following qualifications: that, "if mercurial cachexia in its lesser degrees, and independently of the purging which may attend it, has a real effect on inflammatory products, this effect probably relates only to such products as are not organized, and perhaps is nothing more than the giving of some special assistance to the dissolution and removal of fibrin."

(2.) **CHRONIC INFLAMMATION.**—1. *Iodide of Potassium.*—When inflammatory fever has subsided, and yet the inflammation itself has assumed a chronic form, attended with much effusion, or thickening and induration of the parts affected, iodide of potassium and other preparations of iodine, instead of mercury, to promote absorption of the inflammatory products, are especially efficacious in various specific inflammations, syphilitic, rheumatic, and gouty; as will be seen in the sequel.

In such cases, wine, brandy, ammonia, or other stimulants should be administered, as soon as inflammatory fever has passed into a state of

general depression and exhaustion, the natural sequence of nervous and vascular excitement. Requisite, therefore, as stimulants may be in proportion to the weakness manifested at even an early period, they are sure to become indispensable as the fever itself subsides. And on account of the local condition also, stimulants may be appropriate. When, in the course of inflammation, productiveness predominates, in the shape of effusion and suppuration, it will be necessary to support the circulation under the demand then made; and when destructiveness prevails, it will be even more imperative to sustain all the vital powers under the influence of poisonous matters absorbed in the course of suppuration, pyæmia, ulceration, or sloughing.

3. *Tonics*.—Cinchona bark, the mineral acids, sulphuric, nitric, nitromuriatic, and other tonics, are useful under, perhaps, similar circumstances to those requiring the aid of stimulants, in the treatment of inflammation. Yet these two classes of remedial agents have different, perhaps opposite, effects, in some respects, although it is difficult to distinguish their operation in every particular.

A stimulant certainly produces its effects suddenly and transiently; a tonic, its effects more gradually and more permanently. Then, again, the chief primary effect of the one is to quicken the circulation, as manifested by increased rapidity of pulse; while, the chief primary effect of the other is to strengthen the circulation, and hence an increased force of pulse.

Thus far these two kinds of agents contrast.

Both, however, concur in restoring the balance of the circulation from the depression connected with or consequent on the subsidence of inflammatory fever; and subsequently, in contending against the exhaustion of continued effusion or profuse suppuration; or again, in overcoming the depression arising from absorption of poisonous matters, in the course of suppuration, pyæmia, ulceration, or sloughing.

The mineral acids seem to exercise a special influence on the secretion of the skin, and, indeed, the secretions generally. Having administered the sesquicarbonate of ammonia, as a stimulant, with the tincture of bark or the disulphate of quinine, as a tonic, when first weakness supervenes; the ammonia should afterwards be exchanged for, say, the diluted nitromuriatic acid; this tonic combination of bark and acid being the most effectual means of restraining the sweats of hectic fever, and of cleaning the furred tongue in gangrenous typhoid fever.

4. *Cod-liver oil and nutritious diet* are naturally associated; the one seeming to renovate the power of assimilation, the other supplying the materials for restoration. Both become appropriate, and nutritious diet absolutely necessary, on the subsidence of inflammatory fever, and during hectic, pyæmia, and gangrenous typhoid fever.

Cod-liver oil may be regarded, partly, as a kind of food, supplying a limpid fat which passes easily into the circulation. In the first instance, it is not unfrequently rejected by the stomach or bowels. Beginning, therefore, with a moderate dose, not exceeding a teaspoonful, of pale, transparent, inodorous, and almost tasteless oil, taken twice or three times a day, this quantity may be gradually increased to a tablespoonful. It is best taken in a little milk, as an emulsion, or floating on orange wine, ginger wine, or other light cordial. The addition of a little diluted nitric

acid is highly recommended by Dr. C. J. B. Williams; or if the tendency to nausea be extreme, the thirtieth or fortieth of a grain of strychnine in solution, with each dose of oil, will be found an excellent corrective. A further precaution is, that the oil be taken ten or fifteen minutes after a meal.

The expression "nutritious diet," can scarcely be defined. It is assuredly the opposite to "antiphlogistic diet." Nutritious food, of some kind, will be most needed in proportion to the supervention of suppuration, possibly profuse, and sloughing, possibly extensive. And experience, rather than any chemical knowledge, suggests an increased proportion of animal food, with a liberal allowance of ale or porter, as malt beverages, besides alcoholic stimulants.

Treatment of the Local Consequences of Inflammation.—They are—productively,—effusion and its organization, suppuration, and the formation of abscess; destructively,—ulceration, sloughing, and mortification.

The removal of inflammatory products may be effected either by absorption, or by evacuation; the latter being aided generally by some operative interference.

(1.) **EFFUSION**, consisting of serum, fibrin, and exudation-corpuscles, may be dispersed by a stimulating embrocation of ammonia and olive oil, or of camphor and soap liniment; by mercurial ointments, such as the unguentum hydrargyri nitratis; by the compound tincture of iodine, or by "iodine paint;" and by spirit lotions. The influence of some of these agents is aided by the friction employed in their application. Pressure, uniformly applied by even bandaging, will also promote absorption; and this may be aided by some stimulating agent used conjointly, as Scott's ointment to an enlarged knee-joint.

Absorption is, however, available only in chronic inflammation.

Incision will be appropriate when the inflammation is acute, and accompanied probably with considerable tension, as in phlegmonous erysipelas. In all such cases stimulating applications are inadmissible.

(2.) **SUPPURATION** becoming inevitable in any case, the secretion of pus should be encouraged, by quickening the inflammatory process. Abstaining, therefore, from the further use of any remedial measures for counteracting inflammation, the formation of pus is best insured by warmth and moisture topically applied, as by a light poultice, or moist spongio-piline.

Abscess, or a collection of matter, generally tends to point, and the surgeon should then follow the footsteps of nature. An incision should be made, whenever and wherever *pointing* has taken place, and of sufficient extent to allow a *free* opening for the evacuation of matter, and its discharge as secreted subsequently; these directions constituting the rule of treatment. If necessary, a dependent *counter-opening* may also be made. The ready discharge of pus as it forms. Abscess in certain parts should be opened *early*; indeed, the surgeon cannot be too early in opening abscesses in parts abounding with loose cellular texture, as the neck, neighbourhood of the anus and vagina, popliteal region, and cellular planes between muscles. So also suppuration in fibrous expansions, and in the sheaths of tendons. Abscesses adjacent to mucous canals or important organs; as the

trachea, pharynx, thorax, abdomen, urethra, rectum, and joints. Abscess, moreover, arising from irritant matters, as by the extravasation of urine or feces, should be promptly set free. Abscess in situations less accessible, although urgent, perhaps, in other respects, requires some delay; as with regard to the lungs, liver, spleen, kidneys, and most internal organs.

Methods of Opening an Abscess.—1. To discover the presence of pus the mode of opening an abscess is important. By introducing a bistoury perpendicularly, a drop of matter wells up along the side of the blade, or a half-turn of the instrument will enable it to do so. The puncture thus made is then readily converted into an incision of sufficient extent. This little operation may be rendered painless by the topical influence of the ether-spray. But, by thus freezing the integument, which is already in a low state of vitality, sloughing is apt to follow; and this consideration may be of more consequence than immunity from a few moments' pain.

2. *Hæmorrhage* is usually slight and temporary. But in puncturing a *deep-seated* abscess, there may be some danger. Mr. Hilton, therefore, recommends that an incision be made through the integuments and fascia, so as to expose any muscle under which the pus lies; the cavity of the abscess should then be penetrated by a director, along the groove of which, as a guide, a slender pair of dressing forceps being introduced, the blades are opened, the muscular fibres separated, and free exit is safely given to the pus.

Sometimes, the nature of a swelling or tumour may be doubtful; whether it be solid or fluid, and if the latter, whether an extravasation of blood, or an inflammatory effusion or pus. To clear up the diagnosis, before making an opening with a bistoury to discharge any such fluid matter, it may be advisable to introduce a *grooved needle*. A drop of fluid wells up along the groove, or any solid organized material lodged in the groove is abstracted by withdrawing the needle; and either product can then be examined by the naked eye or under the microscope.

3. The *admission of air* is generally of serious consequence, by inducing purulent decomposition and irritative fever or septicæmia, or prolonged suppurative discharge and hectic exhaustion. Hence, some precaution must be observed in opening any *large* and *chronic* abscess. A *valvular aperture*—as originally proposed by Abernethy—has long been an accredited safeguard. Having drawn the skin well to one side, a bistoury is introduced perpendicularly, as usual, but ere the matter has entirely ceased to flow, the integument is allowed to regain its former position; thus obliquely overlying the aperture in the cyst. A pad of lint and bandage are applied. When the cavity has partly refilled, the same operation is repeated, and as often as may be necessary for the cyst to contract securely and finally close. But when a large chronic abscess occasions no inconvenience, it is a better rule not to open it, rather than endanger the patient's life.

Whether an abscess be acute or chronic, small or large, any thumbing or squeezing would be an unpardonable injury to the delicately organized and highly vascular lining membrane, which, previously pus-forming, should now become lymph-producing for reparation.

The *subsequent escape* of matter will be insured by introducing a strip of lint through the incision, and into the cavity of the abscess, in order

to prevent adhesion of the lips of the aperture, and to promote contraction and healing by granulation from the bottom of the cavity. This safeguard strip of lint is readily passed in with an ordinary probe or director, or with the flat handle of the scalpel. The strip is withdrawn in the course of a day or two, and a fresh piece not replaced, if a pus-discharging aperture be fairly established. If necessary, the discharge may be facilitated by the employment of a "drainage tube," as recommended by M. Chassaignac. It is a small india-rubber tube with lateral holes; and this pipe may be passed, through a cannula, into the abscess, leaving one end hanging out, the cannula then being withdrawn; or the pipe may be introduced by sinus-forceps, or attached to a probe, it can be drawn through the abscess by a counter-opening, and both ends cut off short. The objection to this proceeding, is the irritation caused by the tube, as a foreign body. In fact, it is a seton; and will thus maintain suppuration, if allowed to remain unnecessarily. In *chronic abscess*—as of the lymphatic glands—with congested, bluish, and disorganized integument, whether thick and indurated, or thin and undermined, having made an opening, the irritation of a seton, or stimulating injection, may be resorted to with advantage. But dressing the cavity from the bottom with boracic lint, will generally prove sufficient; or it may be necessary to scrape out the interior, to induce healing by granulation.

Otherwise, the *dressing* of an opened abscess should be unirritating. A light poultice may be applied to encourage the discharge of pus, during the process of granulation from within; or the application of a piece of lint to close the aperture, as soon as possible, will be appropriate, when the abscess is to be reopened from time to time.

Abscesses by "translation," and "secondary abscesses" in the course of pyæmia, should be treated as chronic abscesses; and the more so the larger the size to which they have attained. Obviously such treatment relates only to external, or at least to accessible parts.

4. The *antiseptic method* of opening an abscess was devised by Sir Joseph Lister, with the view of counteracting any contaminating influence from the surrounding atmosphere—due perhaps to germinal matter—and of thus precluding the septic decomposition of pus, consequent on the admission of air to the cavity of the abscess. Accordingly, the abscess is opened with a bistoury in the usual manner, but under the protective influence of some agent, which possesses the power of opposing any such septic change in animal matter—an *antiseptic*; and for this purpose, carbolic or phenic acid is generally employed. The surgeon washes his hands in a carbolic solution, 1 in 40; and uses a knife which has also been laid, with any other instruments, in a solution of the same strength. The *method* of treatment consists, in thoroughly washing the skin around the abscess with the solution, and surrounding the abscess with an antiseptic atmosphere of the carbolic acid, by means of the "spray." Then the opening is made. A carbolized drainage tube is introduced, of sufficient length to just protrude beyond the opening, a small piece of prepared oiled-silk protective being placed around the mouth of the tube, to protect the lips of the wound-aperture from the irritant action of the carbolic dressing; this, in the form of carbolic gauze, six or eight layers thick, is then overlaid, and covered with mackintosh cloth, to exclude the admission of air; and the whole appliance is retained in position by such turns

hæmorrhage may perhaps be stopped by the further support of plugging, with a styptic solution of iron, placed well home upon the bleeding vessel. But where the hæmorrhage is *arterial*, it cannot be arrested by compression, nor by ligature of the vessel alone within the cavity of the abscess, for there the ulcerated or sloughy state of the part forbids the attempt, which might be followed by a fatal recurrence of the bleeding at any time; but we may perhaps trust the additional compression of the main artery above the abscess, or recourse must be had to ligature of that vessel.

(2.) Another complication of abscess may be mentioned, as occurring sometimes when the collection of matter is situated adjoining a mucous canal. Air permeates the cavity of an abscess so placed, or gains access by ulceration; or gas may perhaps be generated by decomposition of the matter contained within the cavity; constituting what has been named a *tympanitic* or *emphysematous* abscess. This change takes place more frequently in abscess lying against the rectum or the pharynx. The sound elicited by percussion, or a gurgling sensation on manipulation, will suffice to make known the admixture of air and purulent fluid, when the situation of the abscess admits of this mode of examination.

No special mode of *treatment* is required; but an early and free vent should be given to the contents of such an abscess, and the cavity syringed out with an antiseptic solution.

Sinus and Fistula require special *treatment*, in some respects. Any assignable *local cause* having, if possible, been removed, as a piece of dead bone, or other foreign body; *pressure* by a graduated compress and bandage, will succeed occasionally in bringing about adhesion, if the sinus or fistula be recent and accessible. *Drainage* affords an efficacious resource when the fistula remains open, owing to the collection of purulent matter below the level of the external opening, or too deep in to have a free discharge. The matter may then be allowed to drain away, either by inserting a piece of drainage tube, or by making a counter-opening; but a proper *position* of the part will sometimes secure the requisite freedom of discharge. The tube acts also as a seton, and so far may promote the healing of the fistulous track; but it must be withdrawn in a few days, lest it should provoke continued suppuration.

When *induration* has taken place, or pressure cannot be applied, *stimulating injections* of sulphate of zinc or nitrate of silver, sometimes answer the purpose. Or a *red-hot wire* introduced up the passage, may prove successful. This is conveniently accomplished by Mr. Marshall's apparatus, whereby a platinum wire, introduced cold, is made red-hot instantaneously by the galvanic current. Generally speaking, however, a sinus or fistula having become indurated, it obstinately resists any attempt to excite adhesion. *Slitting* up the passage with a curved bistoury, on a director if necessary, and healing by granulation from the bottom, must then be had recourse to. A familiar illustration is the operation of fistula in ano. Whenever the persistence of a fistula depends on *some constitutional cause*, the general health must be attended to

as in the case of scrofulous disease of bone, with fistulæ to caries or necrosis.

Septic Fever.—With the exhaustion consequent on prolonged and more especially with purulent discharge, there is associated general nervo-muscular excitement which prevails in hectic

febrility; as denoted by restlessness and sleeplessness, the rapidity, but ineffectual character of the pulse, and trembling weakness of the patient. Accordingly,—in this mixed state of prostration with excitement, the plan of treatment comprises a nourishing diet of such food as may be most readily assimilated, aided by cod-liver oil, and a judicious allowance of stimulants; coupled with the administration of tonics and narcotics,—particularly, in the form of quinine and opium. To check the night sweats and diarrhoea in advanced hectic, the mineral acids, or other astringents, may be given in conjunction with quinine. When returning strength permits, fresh air, gentle exercise, and other hygienic resources, will be most beneficial.

The Destructive consequences of inflammation, i.e. ulceration and sloughing or gangrene, severally present certain indications of treatment.

(1.) **ULCERATION**—as depending on inflammation—may be arrested by counteracting any of the constituent elements of inflammation, which are still in operation. Local antiphlogistic treatment, including rest and an elevated position of the part, is indicated. During reparation, the process of suppurative granulation needs little or no assistance. *Warmth* and *moisture*, by means of a light poultice or spongio-piline epithem, may be continued while the chasm is filling up; rest and position being still observed. Superfluous organizable material—pus—is discharged; and when the granulations have grown to the level of the skin, and are no longer suppurative, the aid of a poultice may be discontinued. Water-dressing, simply to exclude the irritating action of the air, is then alone necessary. This application should be exchanged for some slightly *stimulating* wash, if the pale and flabby state of the granulations suggests the propriety of so doing. A weak solution of sulphate of zinc answers very well. The *pressure* of a bandage will aid its effect, and repress any exuberant growth.

(2.) **SLOUGHING AND GANGRENE** are, in like manner, amenable to local antiphlogistic treatment, with the view of arresting the process of destruction.

Effusion—always an essential constituent of inflammation—is here the element, in particular, to be counteracted or its effect overcome. The *relief of tension* is imperative. Hence, incisions as free as may be necessary, are the primary indication of treatment. Its efficacy is witnessed in phlegmonous erysipelas and carbuncle.

The process of separation of the living from the dead textures, must be encouraged. *Warmth* and *moisture*, by a poultice or spongio-piline epithem, or the more stimulating action of a yeast poultice, will be highly serviceable, both in limiting the sloughing and inducing the detachment of slough. The latter kind of poultice has the advantage of destroying the fœtor of decomposing textures. *Charcoal* in powder, chlorides of lime or zinc, and carbolic acid, are also valuable antiseptic applications. It should, however, be remembered that any stimulant application may overact, and by hurrying on the inflammation beyond that requisite for the ulcerative severation of textures, would cause the gangrene to spread. The line of separation having formed, the detachment of slough has yet to take place. During this period, its extraction prematurely would be attended with hæmorrhage, perhaps considerable.

Finally, the *removal of slough* is an obvious indication which can hardly be overlooked. Dead soft textures are easily withdrawn by the finger or forceps; a sequestrum will require to be extracted from the encompassing sheath of new bone.

The healing of soft textures, subsequently, is by granulation; and the treatment that for a simple healing ulcer.

(3.) FEVER OF GANGRENE.—The constitutional disturbance arising from gangrenous inflammation is of a *typhoid* character; succeeded by some degree of ordinary inflammatory fever in the process of separation of the slough, although this entails more or less exhaustion, according to the extent and duration of the sloughing.

Treatment should be of a generally supporting character; comprising the administration of stimulants and tonics, with as much nourishing food, and of such kind, as can be digested. Often, quinine and ammonia will prove most suitable, or cascarilla may agree better, or gentian, calumba, or hop (*Humulus lupulus*) will be more salutary, by promoting the digestion of food. And the diet should be varied, as including strong beef-tea, eggs, fish, etc., with wine, especially champagne, or stout, brandy or whiskey, agreeably to the patient's previous habits and present tastes.

When the *line of demarcation* is thus induced, these measures may be moderated, and opium given with even more advantage than at an early period; but soon the former plan of treatment must be resumed and reinforced to maintain the circulation while sloughs are discharged, and to gradually renew the health during convalescence.

The treatment of the constitutional disorders,—hectic fever, arising from suppuration, and the typhoidal fever arising from gangrene, is alike thus generally represented by the same remedial measures which come into use as the inflammatory fever declining, is followed by weakness and excitement. Stimulants and tonics, with opium, and a nutritious diet, constitute the resources referred to.

CHAPTER II.

TUMOURS OR MORBID GROWTHS.

(1.) **Morbid Growths** present certain general characteristics, in respect to their Structure and Vital endowments.

1. In common with all other Morbid Products, Morbid Growths are products *additional* to the parts of the body in which they occur. They form Tumours.

2. In their *textural structure*, and in their *physical properties*, Growths resemble the various healthy tissues in which they severally arise. There is a structural homology between the two, and their properties are similar, if not identical; but there may be an essential difference, or heterology. Growths are, therefore, either Homologous or Heterologous; according as they exhibit a greater degree of structural departure from the normal

condition of the tissues in which they are formed. Virchow proposed the terms Hyperplasia and Heteroplasia to represent these relations of Growths, and of New formations generally, to the normal tissues of the body.

3. A Growth generally presents a well-defined boundary, often a distinct *capsule*, by which the included structure can be readily distinguished circumferentially from adjoining textures.

By virtue of their structural homology or resemblance to healthy tissues, Growths may perhaps be regarded as *Hypertrophies*, or over-growths, but as discontinuous from the surrounding tissues; while, by the latter character, they are distinguished from out-growths or hypertrophies continuous with the adjoining tissues, *e.g.* out-growing portions of the thyroid and prostate glands.

4. The *vital* power of Growths is peculiar, and exhibits their essentially morbid character. They possess the *inherent* power of *reproducing* their own structural elements, when adequately supplied with blood as the nutritive material suitable for their production. Hence, I would designate Morbid Growths products of Reproductive Nutrition. They thus increase and multiply. But another vital characteristic is this: they apparently fulfil no useful purpose in the animal economy.

But the vital changes of certain Growths contrast remarkably with the progress of others.

(1.) Some appear to exercise a merely local and mechanical influence; their pathological significance is limited to surrounding parts, which are variously pressed, obstructed, and, possibly, obliterated by absorption. Inflammation, suppuration, and ulceration occasionally occur in parts around, owing to pressure of the tumour, and thus a pendulous growth, more especially, may protrude. Otherwise, the healthy mechanism only of the part becomes impaired by these *localized* Growths. Moreover, when completely extirpated, as by the surgical operation of excision, they never return.

(2.) Other Growths are localized, but they are also *recurrent*, returning *in situ*, even again and again, when apparently completely extirpated.

(3.) And yet other Growths are recurrent but not localized; they gradually pervade surrounding tissues, and affect neighbouring lymphatic vessels and glands; they are prone to undergo ulceration, and by extension of this process thus destroy adjacent parts. They propagate also in different and distant regions of the body, and grow in succession and with increasing rapidity. Growths having these vital characters, are aptly denominated *infiltrating* or *malignant*,—a less expressive term.

No definite line of distinction can be drawn between recurrent and infiltrating Growths; for the former recur *in situ* from some local infiltration of the surrounding tissues, beyond the apparent boundary of the Tumour, and are thus also malignant. Sarcomata and Cancer are both recurrent, and infiltrating. But all other Growths being distinguished by the negation of the latter generic attribute, are non-infiltrating or localized.

Growths are subject to the same *degenerative transformations* of their structural elements as healthy tissues, or the false tissues produced in reparation or resulting from inflammation; fatty, pigmentary, and calcareous degenerations changing the structure and physical characters of Tumours, coupled with a proportionate decline in their vital activity, or

terminating even in the death of the Growth as a natural mode of cure. Rapidity of growth, with a low type of histological development, tends to the supervention of degeneration. *Inflammation* and its consequences may also occur in the course of any Growth; and this liability is perhaps determined by similar conditions.

But, although the vital manifestations of Morbid Growths might indicate a fairly definite classification, and according to their *clinical* differences of relation; the elementary structure of Morbid Growths is more generally accepted, as supplying a more exact basis of classification—with reference to their anatomical or *histological* distinctions, as Tumours.

Morbid Growths may be thus classified, as follows:—

Cysts.

Simple or barren.

Serous. Sanguineous. Synovial.

Mucous. Oily. Colloid. Seminal.

Proliferous.

Cystigerous. Glandular. Cutaneous. Dentigerous.

Cystic Tumours—*e.g.*, Fibrous. Cartilaginous.

Connective-Tissue Tumours.

Fatty Tumour.—Lipoma.

Fibro-cellular Tumour.

Painful Subcutaneous Tubercle. Neuroma.

Glioma. Myxoma. Lymphoma. Cyliodroma. Psammoma.

Fibrous Tumour.

Fibro-calcareous. Fibro-cystic.

Cartilaginous Tumour.—Enchondroma.

Fibro-Cartilaginous. Ossific. Mixed with other Growths.

Vascular or Erectile Tumours.—Angioma.

Nævus.—Telangeiectasis.

Aneurism by Anastomosis.

Osseous Tumours. Exostoses.

Embryonic or Rudimentary Connective-Tissue Tumours.

Sarcomata. { Round-celled.

{ Spindle-celled.

{ Giant-celled.

{ Mixed-celled.

Differential Forms of Sarcoma.

Epithelial-celled Tumours.

Glandular Tumours. Adenoma.

Papillary Growths. Corns. Horns. Warts. Condyloma.

+ Epithelioid. Varieties.—Villous. (Melanotic. Fungus
(hematodes.)

+us. Varieties.—Osteoid.

Varieties.

Cancer.

Ad Cancer.

Adenous Epithelioma.

Adenocarcinoma Epithelioma.

CYSTS AND CYSTIC TUMOURS.

(1.) **Cysts.**—STRUCTURE.—“Essentially, this species of growth is a cyst, sac, or bag, filled with some substance which may be regarded as entirely, or for the most part, its product, whether as a secretion, or as an endogenous growth.” This cyst, sac, or bag, is either solitary, or frequently aggregated with others; and each may be free and movable, or imbedded in the substance of some other growth, thus forming a “cystic tumour.” But the contents of the cyst or cysts are the chief features of distinction.

Some contain fluid unorganized secretions, and are spoken of as *simple*, or more correctly, *barren* cysts.

Others contain organized, endogenous growths, and these are denominated *compound*, or more appropriately, *proliferous* cysts.

1. **SIMPLE CYSTS.**—A cyst is formed of fibro-cellular tissue, but without an epithelial lining. This is present in the more finished cysts, and is usually the tessellated variety of epithelium. A more perfect secreting surface is thus prepared, and the varieties of simple cysts take their names from the nature of their secretions—their contents. Thus we recognize the *serous*, *sanguineous*, *synovial*, *mucous*, *oily*, *colloid*, and *seminal* cysts.

These barren cysts may be found in almost any part of the body.

2. **PROLIFEROUS CYSTS.**—The organized growths within a proliferous cyst are sometimes simple cells, detached, or pedunculated and attached to the interior of the cyst whence they have sprung. Thus are formed the common *cystigerous* ovarian tumours.

Glandular proliferous cysts are so named from their containing some kind of organized substance or substances, the structure of which resembles some kind of healthy gland-tissue, and for the most part that in which the cysts are imbedded. The thyroid and mammary glands, and perhaps the prostate and labial glands, are the chosen seats of this species of cyst. But a glanduliferous cyst may be developed apart from any connection with a secreting gland.

Cutaneous proliferous cysts are so called from their structure consisting of, or containing, skin or its remains, with hair, or other forms of epidermic tissue, and fat. These cysts are not necessarily confined to the skin, as sebaceous and atheromatous tumours or wens, but are more commonly found in ovarian tumours; and, very rarely, in the testicle, lung, kidney, bladder, sublingual tissue, and within the skull. Teeth may also be discovered within capsules in abnormal situations, as in ovarian tumours, and the jaws; and such capsules have received the name of *dentigerous* proliferous cysts.

Signs and Diagnosis.—1. A *simple* or barren cyst, with its fluid contents, necessarily implies a circumscribed and fluctuating tumour, or the resistance only of fluid pressure. A collection of such cysts presents similar characters. The resistance of the circumscribed fluctuation varies in degree, from that of the most fluid, to that of the most solid-feeling thick fluid; as grumous blood, synovia, mucus, or the butter-like consistence of sebaceous cysts.

By puncturing any supposed cyst with a grooved needle or with a fine

trocár and cannula, its contents can be examined, simply by inspection, or under the microscope.

2. The *proliferous* development of a solid growth within a parent cyst, is especially observed in sero-cystic disease of the breast, and in cystic bronchocele. A tumour, originally fluid and fluctuating, is thus converted into an unbroken solid mass; but during this transitional change the growth, not yet completely filling the cyst or cysts, is immersed in fluid, so that the whole feels a mixed tumour—partly fluid, partly solid.

Ultimately, if one of the cysts should burst from over-distension, or if it be artificially laid open, the growth within, no longer restrained, increases, and protruding in the form of a fungus, gives to the tumour a new and characteristic appearance.

Diagnosis from other Swellings, or from Tumours.—A thickened cyst simulates the characters of other tumours. (1) It may resemble a *chronic abscess*, i.e. without the pain, heat, and redness of inflammation, only presenting swelling with fluctuation. But the pus-cyst, so to speak, is more blended with surrounding tissues,—it is less circumscribed than a cyst which has merely become thickened. An ordinary cyst is sometimes actually converted into a painless chronic abscess. The diagnosis is then most difficult. (2) No less important is it not to mistake a cyst or cystic tumour for a soft *sarcoma*, or a *cancer* of gelatinous consistence—colloid. An exploratory puncture will here supply the material for distinction, under examination with a microscope. (3) A soft *fatty* tumour may also resemble a cyst, or collection of cysts; the uneven lobular shape, and semi-fluctuating character of the tumour, being also similar. Puncture may be here resorted to. But the situation of the tumour, and its manner of growth, will often afford trustworthy evidence in aid of the diagnosis.

(2.) **Cystic Tumour.**—A cyst or cysts within the substance of a solid tumour renders the diagnosis more obscure than when not so imbedded. Thus, cysts are, occasionally, set in the substance of a fibrous, fatty, or cartilaginous tumour, or in cancer-growth, and perhaps no kind of tumour is exempt. Cyst-formation in tumours occurs most frequently in glandular organs; as in the mamma, and testicle.

The *physical signs* of cysts in tumours are palpable. A circumscribed boundary, and fluid resistance, in some degree, to the touch, invariably accompany the presence of a cyst or collection of cysts.

CYST-FORMATION, whether barren or proliferous.—Three modes of production are tolerably well established; but no accurate classification of these growths can be determined upon this ground of distinction. Cyst-formation is as follows:—

Firstly.—By the dilatation and coalescence of the spaces in cellular tissue, a *rudimentary cyst* is formed, and afterwards finished off on its internal surface

Thus

It

is smooth, and perhaps lined with epithelium.

in adventitious bursæ, e.g. the little sac which

is underneath the skin of an old corn.

formed from areolar tissue may acquire a *proli-*

occasionally in adventitious bursæ, from the
ulous little polypi sometimes grow.

ation and distension of certain natural cavities

are produced *retention*-cysts, so named by Virchow. The contents of such cysts are usually some secretion, more or less changed by retention; as milk, saliva, sebaceous matter. The dilatation of gland-ducts may thus give rise to cysts. Natural bursæ sometimes enlarge, and become distended with synovia. The bursa betwixt the skin and patella thus enlarged, and known as "housemaid's knee," is a familiar example. Mucous cysts, by enlargement of the Nabothian gland-follicles about the cervix uteri, or of Cowper's glands in the female, situated just within the vagina, are further illustrations of cyst-formation by dilatation and distension of a natural cavity with its own fluid. Fat-cysts are produced in this way, out of the sebaceous and hair follicles, forming common wens. Graafian vesicles, by overgrowth, are evolved into ovarian tumours.

A simple cyst formed by the expansion of a natural cavity, may become *proliferous*, a soft-lobed growth having sprung from the interior of the cyst; and this truth is confirmed by the proliferous power of the lactiferous tubes when enlarged in certain cases of sero-cystic disease of the breast, and the prolific growth of cells in the parent cysts of an ovarian cystic tumour.

Thirdly.—Erring cells themselves may each acquire sufficient size to merit the name of a cyst. The cells which naturally inhabit the villi of the chorion, according to Dr. Mettenheimer, occasionally enlarge into cysts, and form the hydatid mole. From erring cells are sometimes produced serous cysts in the neck, in the thyroid body, in the gums, in the mammary gland, and a cystic condition of the choroid plexus. By this mode of origin, also, may be evolved certain sanguineous cysts, *e.g.* in the neck; certain adventitious synovial bursæ, *e.g.* ganglions formed in connection with the sheaths of tendons; and certain seminal cysts. (Paget.)

A surprising *proliferous* power is frequently manifested by cysts derived from erring cells, of which some instances of cystic diseases of the breast and other glands are probably illustrations.

Treatment.—Cysts and Cystic Tumours are amenable to treatment, in accordance with certain general indications.

1. *Simple* or Barren Cysts, containing unorganized secretions of various degrees of fluid consistence, may be effectually reduced by absorption, destroyed, or removed, by one or other of the following modes of treatment:—

Stimulating applications, as the compound tincture of iodine, may induce absorption of the contents of the cyst; and if no re-secretion ensues, a cure will thus be effected.

Puncture, and a stimulant injection, or the introduction of a seton, may succeed in obliterating the cyst by adhesion of its interior, or destroying it by suppuration and sloughing, and in either way effecting a cure.

Excision of the cyst is a procedure available when other resources have failed, or more advantageously, in the first instance, before the textures have been tampered with by any other treatment.

2. *Proliferous Cysts*.—*Excision* is the only sure and safe mode of treatment; removal of the cyst or cysts entirely, by the knife, being necessary to overcome the productiveness of any such cyst. Cystigerous, and glandular, proliferous cysts, the latter especially, render this proceeding the more necessary. Cutaneous proliferous cysts also are more properly excised, as, the common scalp-wen.

CONNECTIVE-TISSUE TUMOURS.

Fatty Tumour.—Lipoma.—STRUCTURE AND CHARACTERS.—This growth is of *soft*, doughy consistence, defined or circumscribed, deeply and largely *lobulated*, and freely *movable*; sometimes shifting from its original locality owing to the looseness of its connection; growing slowly, the tumour often attains to a large size and great weight, even to fifty pounds; but it has no tendency to ulcerate, nor to reproduction, when removed.

It has the composition and general structure of *ordinary fat*—i.e. fat-cells, collected together, and imbedded in a fibrous mesh-work, more or less abundant, and resembling condensed cellular texture; this, however, is continuous with a thin fibro-cellular *capsule* enclosing the tumour; prolongations of which, penetrating the mass, separate it into lobes, while, externally, the whole investment is loosely connected with surrounding parts. *Blood-vessels*, collected mostly at one point of the tumour, pass into its substance from the cellular capsule. A cavernous dilatation of the veins has often been noticed by Billroth.

VARIETIES, AND DIAGNOSIS.—(1) Occasionally, the cellular capsule is thick, dense, and fibrous. Its prolongations may also become fibrous and firm, or even calcified. The whole substance of such a tumour is hard and comparatively immovable, and although still circumscribed and lobulated, resembles a fibrous tumour. The *lardaceous* variety is of this description. (2) *Hard fibrous knots*, as of the fibro-cellular stroma, or even bony nodules, can, occasionally, be felt within a tumour otherwise fatty. Or the mass may be, or become, softer than usual. *Oleaginous* fat, with but slight fibro-cellular partitions, presents the characters of a bag or cyst of fluid, and gives out the physical signs of a fluid encysted tumour. (3) True *cysts* are, occasionally, developed in a tumour otherwise fatty; thus giving the consistence of roundish elastic bags of fluid set in a doughy substance. (4) Still more rarely, suppuration occurs, centrally perhaps, within a fatty tumour, and forming a *chronic abscess*, simulates the character of a cyst.

Situation.—Fatty tumour most commonly occurs in the subcutaneous adipose texture, especially of those parts where fat normally abounds in the healthy state, and is liable to accumulate; as about the trunk, *e.g.* on the back, neck, and shoulder. It is usually a *solitary* growth; but several may co-exist, from two or three, up to as many as a hundred, or more—*Multiple Lipoma*.

Treatment.—*Absorption* of a fatty tumour is perhaps possible, under the influence of medicinal treatment. Thus, this kind of growth is said to disappear occasionally under the influence of liquor potassæ, administered in half-drachm doses, gradually increased to a drachm, and continued for a month or more. In one case, the tumour was sensibly diminished in size by this mode of treatment, which was originally tried by Sir B. Brodie.

Excision, as a rule, is the only successful treatment.

Dissection, even among parts of anatomical importance, is scarcely requisite. The lobulated mass rolls out of its bed or is easily detached, until some corner appears where the nutrient vessels enter. Hæmorrhage

considerable, but when these vessels are divided, a ligature or two be needed. Any small portion of the tumour left behind is immaterial, it ceases to grow. The portion of skin to be removed is not so extensive as would at first sight appear necessary. Any small portion cut by pressure, and any superfluous portion, may be included in the excision; but the remaining integument will retract and pucker up, after operation.

Fibro-cellular Tumour.—This tumour is distinguished from polymucous or cutaneous, chiefly by its relation to the adjoining texture. It is an over-growth; but while polypus is merely an out-growth of cellular tissue, the same structure, as a tumour, is distinctly isolated by a capsular investment.

STRUCTURE AND CHARACTERS.—The mass is roundish, and of tolerably regular outline, usually deeply and *largely lobed*. Its chief physical character is a remarkably *elastic tension*, due to the structural resemblance of this tumour to dropsical cellular tissue, circumscribed. It may grow to a great size and weight, perhaps forty pounds. A section shows a yellow surface, marked with white lines, which have a wavy or undulatory direction across the tumour, and may divide its substance into distinct lobes.

The yellow substance, the white bands, and the capsule, alike consist of *fibro-cellular tissue*, more condensed in the latter portions; but the whole is remarkably succulent, being infiltrated with a serous fluid, which exudes plentifully and continues to ooze from the cut surface.

This tumour represents an *immature* state of the normal fibro-cellular tissue. With many well-developed filaments, there are more abundant nuclei and cells forming fibres—spindle-shaped cells, or with filamentous prolongations, in various stages of development. Yellow elastic tissue is rarely present, unlike its frequency in ordinary connective tissue.

Situation.—Fibro-cellular tumour occurs most frequently in the labium, or tissues by the side of the vagina; or in the deep inter-muscular spaces in the thigh and arm. It is usually *solitary*.

Treatment.—Excision of a fibre-cellular tumour is the only effectual mode of removal. The operation cannot be accomplished with the same facility as that of a fatty tumour. Nevertheless, a thin capsule defines the circumscribed mass, its connections are not very close, and the hæmorrhage is slight compared with the size of the tumour.

Painful Subcutaneous Tumour or Tubercle is a peculiar variety of *fibro-cellular tumour*, to which and to fibrous tumour it is *structurally* allied; but peculiar, if only as *distinguished* by the *pain*, intense, burning, and paroxysmal, to which the tubercle is subject. The attack arises from a few minutes to some hours, and may recur again and again, leaving only a tenderness in the spot whence the pain had abated. Thus far it resembles neuralgic pain; but the gradual accession and subsidence of the attack, and the aggravation of the pain by pressure, seem referable rather to neuritis, of a recurrent character. This cannot be accounted for by the structure of the tumour, which is composed itself destitute of any nerve-filaments, nor by any special relation to adjacent nerves.

This painful tumour, *situated* in the subcutaneous cellular tissue, is not visible, and scarcely projects. It is also of *small size*, that of a

pea or an oat, and rarely exceeding half an inch in diameter; but it can be readily felt, as a roundish body, very firm and elastic. Isolated by a capsule, this hard body is free in the subcutaneous tissue, and is, therefore, so far *movable*; but it may be intimately *adherent* to the skin, and move with it when pressed under the finger. The superimposed skin, if adherent, has the general appearance of a cicatrix; it is slightly puckered, stretched, glistening and white, unless during a paroxysm of pain, when it may become congested and swollen, and the surrounding blood-vessels turgid.

Neuroma is characterized by the presence of nerve-filaments in, or spread over, the mass, which is of roundish or oblong shape, the size of a pea, a Barcelona nut, or larger. A large number of such tumours are often produced in various parts of the body, not less perhaps than two thousand having been found in one unprecedented case. (R. W. Smith.) Neuroma—more properly so called—as consisting of nerve-fibres, is also met with; usually, as forming *bulbous enlargements* in the ends of divided nerves, after amputation not unfrequently; but sometimes occurring as nodular out-growths in the continuity of a nerve. These neuromata are the source of intense pain.

Situation.—Painful subcutaneous tumour or tubercle occurs, as its name denotes, beneath the skin; and especially in the extremities, more particularly the lower limbs, very rarely on the trunk or face. It has, I believe, been found deeply imbedded in the substance of muscle.

Treatment.—*Painful tubercle* can be cured by no topical applications. But *excision* is resorted to, and with the ready concurrence of the patient, to exterminate, so to speak, the otherwise excruciating paroxysmal pain in the tumour. The pain may perhaps be relieved, for a time, by firm pressure with a metallic ring placed on the circumferential portion of skin. I am not aware that pain ever recurs in the cicatrix, although free excision may be advisable, as a precaution; assuredly the tumour itself never returns, when completely extirpated.

Neuroma is also amenable only to *excision*. The nerve-filaments, enclosed in, or expanded over, this little tumour, must generally be divided. Occasionally, the tumour can be dissected out of the nerve, leaving it intact. This more conservative mode of excision is especially important in the case of a large nerve, as the sciatic. But the presence of more than one, sometimes very many, neuromata in various parts of the body, may render any operation useless.

As a palliative, in these forms of painful tumour, the topical application of the most benumbing anodynes, *e.g.* the tincture of aconite, is worthy of trial.

Glioma.—A variety of SARCOMA is thus named by Virchow, from its *originating* in the neuroglia or *connective tissue* of nerves; but it is a nervous element, only round cells of variable size—as in or with offshoots, and an intercellular substance, which is ly fibrillated.

* be *soft*, resembling myxoma or medullary cancer, or of like *fibrous* tumour; but it is not incapsuled. Section r *surface*, translucent, and bluish-white or pinkish-grey. *course* at an early period of life, and more often forms e *eye*, but also in the brain, and in other parts. The

malignant nature of this round-celled sarcoma is ultimately manifested by some infiltration of the surrounding tissue, and its fungating character; sometimes also by infection of the lymphatic glands, and by the reproduction of secondary growths in distant internal organs.

TREATMENT.—Excision is the only cure; and at an early period, recurrence is improbable, unless the cells are of large size.

Myxoma—so named by Virchow—or *mucous* tumour, originates in moist and soft connective tissue, and consists of a modification of that texture; spindle-cells, or in a stellate form, anastomosing; with an abundant, homogeneous, soft and viscid intercellular substance, which yields mucin. A few blood-vessels ramify through this substance. A thin capsule of condensed cellular tissue defines the tumour; and partitions passing inwards may give a slightly lobulated form to the growth.

Its *consistence* is remarkably gelatinous, loose and juicy, like that of the umbilical cord; and on section it trickles away in thick gelatinous strings, presenting a greyish, or faintly pink surface.

Such tumours may be found in the *connective tissue* of many organs or parts; the *eye*, or the brain; in the interstitial tissue of nerves, in the medullary membrane of bone, in subcutaneous tissue, as near the angle of the jaw; or deep in the thigh, in the breast, in the jaw, or in the nasal fossa.

As a *mixed* tumour associated with other textural elements, as fat, bone, or cartilage, the growth may attain a large size, still of slimy softness.

TREATMENT by extirpation with the knife will always prove a permanent cure, when the locality of the tumour admits of a complete removal.

Lymphoma, or Lymph-gland Tumour, another Growth belonging to the Connective-tissue Series, will be considered in connection with Diseases of Lymphatic Glands.

Fibrous Tumour.—**STRUCTURE AND CHARACTERS.**—The great *firmness* and *elasticity* of this growth are peculiar; and less so, its *spheroidal* shape when uninfluenced by the pressure of surrounding parts, and its occasionally lobulated character. The tumour sometimes attains a large size and weight, even seventy pounds. Its chemical basis is gelatine, but the other constituents are unknown.

On *section*, it commonly presents a greyish colour, sometimes a yellow, brown, or bluish tint, and variously intersected by white opaque lines; the surface assuming a convex form, like that of an inter-vertebral fibro-cartilage, owing to the elastic tension of the texture.

It consists of the white, and perhaps the yellow or elastic fibres of ordinary *fibrous tissue*, which have an undulatory arrangement; or a concentric disposition round distinct axes, with intermediate waving filaments; occasionally, a uniform aspect, without any marked fasciculation.

Like fibrous tissue, it is but scantily supplied with *blood-vessels*, which pass into the substance of the tumour from a fibro-cellular *capsule*, conducted by thin, unsheathing partitions, in the lobulated form of growth; and the capsular investment is more apparent around those tumours which are imbedded in solid organs. *Nerve-filaments* do not seem to enter into the proper substance of a fibrous tumour; but, accord-

ing to Billroth's observations, the fibrous texture may form around nerves and blood-vessels, and thus both may occupy the centres of the concentric arrangement of fibres.

Muscular fibres, of the *unstriped* kind, are sometimes associated with the *fibrous tissue*—Myoma, or Myofibroma; e.g. Uterine fibrous tumour.

Situation.—Fibrous tumours are formed in connection with the fibrous or fibro-cellular textures; most commonly in the substance of the *uterus*. Connected sometimes with *bone*, and—like cartilaginous tumours—formed either in its substance, or between it and the periosteum. The jaws are most liable to this kind of growth.

Fibrous tumour is usually a *solitary* growth; excepting in the nerves or uterus, in either of which several may co-exist.

VARIETIES.—Earthy matter or cysts may be found within the substance of this growth, and hence the terms (1) *fibro-calcareous* and (2) *fibro-cystic*, as designating these modifications. (3) *Recurrent fibroid*, and (4) *Fibro-plastic* varieties, are forms of *SARCOMA*.

Treatment.—Excluding this form of growth in the uterus, *excision* is still the only known remedy. A thin capsule defines, and but loosely attaches the tumour to surrounding parts, from which it can be easily split; and the hæmorrhage is inconsiderable, as pertaining to the tumour. In connection with bone, the attachment is very close, and the basic portion of bone will probably have to be removed. *Enucleation*, or simply turning the tumour out of its bed, is available in some instances; chiefly for the removal of uterine fibrous tumours.

Cartilaginous Tumour.—Enchondroma.—**STRUCTURE AND CHARACTERS.**—This tumour presents the appearance, the chemical composition, and the structure of masses of *fatal cartilage*. It is enclosed in a tough fibrous *capsule*, which conducts a few *blood-vessels*.

The surface of a cartilaginous tumour is more or less irregular, *lobulated*, and *firm*; the fibrous capsule passing in between and separating the lobes; the whole mass varies also considerably in size, from that of a pea to the bulk of a man's head, or growing even to enormous dimensions. Its substance is pulpy or more consistent, it may be *hard*, but *elastic*.

Crisp when cut, a *section* is bluish-white, like London milk, glistening and translucent.

Two *structural elements* are found, the same as in ordinary cartilage; cells, and an intercellular substance, the latter being semi-transparent or molecular and dim, but more commonly fibrous. These elements are associated in variable proportion. The cells may be scattered or aggregated, multiform, and they resemble either mature or rudimentary cartilage-cells. Their envelope is, therefore, more or less defined; it encloses one or more nuclei, within each of which is seen a nucleolus or two. Occasionally the nucleus appears radiated, not unlike the lacunæ and surrounding canaliculi of bone. *Blood-vessels* may be found permeating the intercellular fibroid matrix, which are not present in normal cartilage—a distinctive structural character. (Billroth.)

Situation.—Cartilaginous tumour is most frequently connected with the *bones* and *joints*; especially those of the hand, i.e. phalanges and metacarpus; the corresponding bones of the foot, particularly the last phalanx of the great toe; the lower end of the femur, neighbouring end

ibia; the humerus, scapula, sternum, ribs, ilium, and cranium. Sometimes from *cartilage*, in the form of out-growths, enchondromas may be found on the articular cartilages; or in *glands*—the parotid gland, mammary gland, and other organs.

Kind of growth is not unfrequently *solitary*, excepting in connection with the bones of the hands or feet, where several may co-exist.

VARIETIES.—(1.) *Ossification* sometimes take place, constituting *osteoma*. (2.) The tumour may *soften*, as from fatty degeneration, like a fatty growth, or a mass of colloid cancer; or ossific nodules may be present and feel like a group of cysts. (3.) Lastly, it may be associated with other growths, forming *mixed* tumours; e.g. *sarcomatous chondroma*, consisting of an admixture of spindle-cells with the cartilage. The tumour will then not only recur, after removal; but, by infecting the lymphatic glands, and even reproducing cystic growths, this combined form of enchondroma may approach the malignancy of cancer.

The *Myeloid* or marrow-like variety is a form of Sarcoma—classified.

TREATMENT.—Cartilaginous tumour must be removed by surgical means. Owing to the firm attachment of the tumour to bone, in the majority of cases, *amputation*, rather than *excision*, is indicated. It should also be remembered that the part operated on may be rendered almost useless, by the magnitude of an excisional procedure, or from inflammation consequent on the interference with tendons in removal of the tumour. Thus, a finger subjected to such operation may become more useless than before. The performance of excision is aided by certain circumstances. The mass, usually lobulated, is defined by a tough capsule covering the whole surface, excepting at the base of attachment. Within this capsule investment is complete. In either case, the capsule is continuous with the texture around, by a dry connective tissue which can be easily split up. The hæmorrhage is but slight, as occasioned by the removal of the tumour, itself only sparingly vascular; and the surrounding textures are singularly healthy.

Excision of a cartilaginous tumour from within bone is more often practised.

Arterial or Erectile Tumour.—Angioma.—STRUCTURAL CONNECTION.—This tumour essentially consists of a conglomeration of blood-vessels connected together, more or less intimately, by *fibro-cellular* or connective tissue, which may form an investing *capsule*; the whole being circumscribed as a distinct tumour, but of irregular shape, and lobed; or, the mass not being distinctly isolated, is *diffused*, and shades off into the surrounding textures.

VARIETIES.—Three varieties or species of this tumour are well defined, and easily recognized when formed in or under the skin.

The *first* consists almost entirely of *capillaries*—dilated, tortuous, and dilated, as in “*nævus maternus*” or “*mother’s mark*,” also known as *nevus*. The vessels are for the most part a new formation. The *second* is formed almost entirely of enlarged *veins*, or venous sinuses imbedded in a firm, fibrous network,—constituting an *erectile tumour*. In some such erectile tumours, the trabecular structure forms a network of spaces, lined with the vascular endothelium, communicating

with the vessels—thus constituting a “cavernous angioma.” (3.) The *third* variety consists almost entirely of *arteries*—enlarged, elongated, tortuous, and perhaps convoluted, and which freely communicate—“aneurism by anastomosis.” If the larger vessels are involved, it has received the name of “cirsoid aneurism.”

SIGNS, AND DIAGNOSTIC CHARACTERS.—A vascular tumour is *soft* and *compressible*, but *regains* its former size when the congeries of vessels is left free to fill again,—the tumour is *erectile*. Its substance somewhat resembles a sponge; and if visible, as when *subcutaneous* or *in the skin*, the colour of this distended sponge plainly shows that it is full of *blood*, arterial or venous. (1.) The *capillary* and *venous* varieties are alike characterized by their circumscribed shape and soft doughy consistence, which can be moulded under the fingers; but at the same time a trembling sensation or *indistinct throbbing* is felt, if the mass for the most part be venous, and have attained some size. After compression, the tumour *slowly re-distends*, and assumes increasing size and tension during exertion, especially if sudden and violent, as in running, coughing, straining, struggling; and by any obstruction to the free return of venous blood. A *bluish* tint is perceptible when the tumour is situated superficially. Lastly, if wounded, the mass collapses. (2.) The *arterial* variety is chiefly distinguished by its *strong pulsations*, and threatening distension, increasing also under any occasional excitement of the heart's action, and with the flow of arterial blood. The pulsations are peculiarly marked in cavernous erectile tumour.

Situation.—This species of tumour may be *deep-seated*; in *bone*, the stomach, and other internal organs; in the *orbit*, parotid gland, the tongue, and indeed wherever capillary blood-vessels naturally exist and most abound. The diffused form is more frequently situated beneath the skin, and probably involving it; constituting the common cutaneous *nævus*, as seen on the scalp or the face.

Treatment.—(1.) Absorption, by compression, steadily maintained by means of the air-cushion and spring. Compression is most practicable and effectual when the tumour rests on bone, thus supplying counter-pressure.

(2.) Obliteration, by cauterization, or injections, for the purpose of producing sloughing or consolidation of the tumour. Either plan of treatment is most appropriate for *small* vascular tumours, which may be destroyed by the application of strong nitric acid with a glass-brush, or by the injection of perchloride of iron, drop by drop at different points, by means of a glass syringe, having a screw piston and a fine penetrating nozzle. Setons of silk, passed through various parts of the tumour, and allowed to remain in for some days, will, perhaps, more slowly produce the same result.

But such applications are useless, or perilous, generally. Purulent infection is apt to follow, or fatal embolism from a clot entering the circulation.

Ivano-puncture, or subcutaneous puncture with a fine tenotomy-needle to destroy the growth, are sometimes more effectual methods of cure.

Removal, by ligature. This method is appropriate for vascular tumours, larger, and, therefore, more arterial or venous, than those which

can be safely obliterated by caustics or injections, or in cases where such treatment has failed. Cessation of pulsation, or only a thrilling tremor in the tumour, and inability to reduce it by pressure, are signs that the operation of ligature has been effectually performed. The methods of operation are those for the removal of *nævus*, and aneurism by anastomosis.

Excision is applicable chiefly to *encysted* subcutaneous vascular tumours.

Nævus.—This species of vascular growth in the skin consists of *capillary vessels*, enlarged, tortuous, and convoluted in the form of lobuli, and extending down into the subcutaneous cellular texture. But the vessels in either situation may be almost solely affected, forming the *cutaneous* and *subcutaneous* varieties of *nævus*.

The *characters* of *nævus* are commonly these: it is a vascular cutaneous spot, of a dark red or steel-blue colour, flattened, but somewhat raised above the skin; soft and compressible, painless, perhaps slightly pulsating under the finger, but disappearing on pressure, and returning when again set free; the vascular distension being increased by coughing, struggling, or any other effort which affects the circulation. Such a spot is usually congenital,—as a “mother’s mark,” it is situated generally on the scalp, face, or back of the neck, and varies in size from a pin’s head to that of a half-crown, or larger. It is often single, but there may be two, three, or more vascular spots. Stationary *nævi* of this description are known as “moles.” A less common form of *nævus* is that which presents a vascular patch of skin, having a deep red or claret colour, and extending over a large portion of the surface, as the side of the face, and perhaps down the arm and trunk.

TREATMENT.—When of *small size*, cutaneous, and not progressively increasing, a *nævus* may well be left to itself; and it may atrophy, wither, and disappear. When of *large extent*, although superficial, as on the face, presenting the appearance of a large purple patch, such *nævus* must be left alone; it is irremovable, albeit a great disfigurement. But, when *nævus* is of *large size*, or subcutaneous, and *increasing* in size, occasioning also much disfigurement; operative interference becomes necessary, and indeed urgent in proportion to the development of these characters.

Operations for the cure of *nævi* may be performed with a view either to their obliteration, or to their removal: (1) To induce adhesive inflammation in the substance of the tumour, with coagulation of the blood, and permanent plugging of the erectile tissue—by injection of perchloride of iron, two or three drops; or by cauterization, with the strong nitric acid or potassa fusa, in order to thus destroy the growth; (2) removal by excision, with the knife; or by ligature.

Ligature is the only method of removal which must be had recourse to, in all conditions of *nævus*, when of *large size*, and not encapsuled. The hæmorrhage attendant on excision would be dangerous or fatal, and can only be prevented or controlled by ligature.

Accordingly, the objects to be accomplished are—the complete and immediate strangulation of the vascular tissue, observing to include the whole tumour, and well around the limits of the disease; but avoiding the skin, which may be *divided* in the intervals of the ligatures, or a single ligature may be passed around the tumour, *subcutaneously*.

Small, firm, round whipcord answers best. The *navus*-needles are curved, and firmly set in wooden handles, resembling aneurism-needles.

Nævus, of moderate size, and in a situation where cicatricial disfigurement is not of much consequence, may be ligatured by two double ligatures passed underneath the base of the tumour, and crossing in opposite diameters, so as to divide it into four sections; the skin is then divided circumferentially, in the intervals of the ligatures, which are successively drawn sufficiently tight around the base of the tumour, and tied in a reef-knot. To fix the ligatures around the base of the tumour, two hare-lips may be passed crossways beneath the base, and the threads tied under the pins. Or, a single ligature encircling the base—under the pins, will strangle a small *nævus*. An ordinary *nævus* on a child's head, generally thus admits of ligature, in one or other of these ways. The tumour, when effectually strangled, sloughs in a few days, leaving an open sore, which granulates and cicatrizes.

Nævus of larger size, and so placed that the sacrifice of integument would entail much disfigurement, may admit of subcutaneous ligature; the skin being left entire in this operative procedure, and consequently not sacrificed by sloughing. The *navus*-needle, armed with a double ligature, is introduced at some point of the base of the tumour, and carried round its circumference to the same point; the cord is drawn out into a single ligature, the needle withdrawn, and the two ends pulled steadily and tied tight enough to thoroughly strangle the included mass of vascular tissue. If the mass be so large, or so placed, that it cannot be thus encompassed by a single passage of the ligature, then the needle-point may be made to emerge at a convenient spot, one end of the cord drawn out, the needle withdrawn, and having been re-threaded with that end of the ligature, it is re-introduced at the point of emergence and carried round the remainder of the tumour to the point where it was first introduced; the operation being completed by strangulation and securing the ligature. A *nævus* on the cheek can be removed by this method, without any resulting disfigurement, more than a puckered appearance. I have known a dragging down of the lower eyelid to ensue, but this can be remedied by the operation for Ectropion. Ligature may be employed at an early period of life; in infants a month or two old, and with a successful result.

Aneurism by Anastomosis, consists of enlarged, elongated, tortuous, and perhaps convoluted arterial vessels, which freely communicate. The tumour or swelling has an ill-defined outline, and presents, when near the surface, a flattened but irregular aspect,—corresponding to the eel-like arteries; and its distinctive character, as a vascular tumour, is its strong pulsations. This species of vascular growth is situated, most commonly, in the subcutaneous, or the submucous cellular tissue; especially of the face, neck, or the orbit, and occasionally of the tongue. Or the may be deep-seated, as in muscle or bone. Its origin—unlike is not congenital, but the growth commences usually in childhood; sometimes referable to a blow or other injury of the part affected. **sent.—Ligature.**—The tumour may be removed by ligature, a circumferential feeding branches, or of the main trunk of

per procedure has not been followed by successful results; ten

d cases having failed, without one single instance of ultimate cure. In two cases, however, where the scalp was the seat of aneurism by anastomosis, Gibson aided the effect of circumferential ligatures by passing them around the tumour in the intervening spaces; and this procedure was successful.

Ligature of the main trunk has been practised on the carotid, when the tumour was seated on the scalp, or in the orbit; or the brachial, and other arteries, have been ligatured, when the disease occurred on the neck. The carotid has been tied in twenty-three recorded cases; in five of which, both arteries were tied at intervals of several weeks. Ligature proved successful in some of the cases; double ligature in others. Ligature of the carotid for aneurism by anastomosis in the neck has been performed in thirteen cases; with a successful result in the majority.

These two procedures—ligature of the circumferential arteries, and of the main trunk—may be combined or practised in succession, and the results aided by intervening incisions.

Other methods of treatment have been resorted to, but with less or less success: excision, with previous ligature of the circumferential arteries; obliteration, by injection; or compression.

Osseous Tumours are more properly considered in connection with the bones of the Bones. The Osteomata comprise Exostoses or osseous growths, and Tumours growing in bone, which are more or less malignant, as Osteo-Sarcoma and Osteoid Cancer.

EMBRYONIC OR RUDIMENTARY CONNECTIVE-TISSUE TUMOURS.

Osteomata.—The class of Tumours included under the common name of Sarcoma is ill defined; whether in regard to their structural characters, or their clinical characters; and the one have no definitely connecting association with the other, thus rendering the Sarcomas less distinctive from other Tumours. On the one hand, this class of Tumours is allied, structurally, to various typical forms of Tumours, belonging to the connective-tissue series—as already noticed in connection with Fibro-cellular Tumour, Fibrous Tumour, and Enchondroma; differing in their vital characters of recurrence, and possibly, glandular, with secondary formations in distant parts; and thus, on the other hand, the Sarcomas approach to, and merge into the vital history of Cancer-Tumours.

Sarcomas, in general.—**STRUCTURAL CONDITIONS.**—A Sarcoma belongs to the connective-tissue series of Tumours; but the cell-elements present various rudimentary, immature, or developmental forms—indicating an embryonic connective-tissue Tumour. The cells are found in a more or less abundant intercellular stroma; with vessels situated therein—often to an amount which renders the tumour very vascular. The cells multiply, mostly by cleavage-division.

The cells appear in four forms; thus distinguishing Sarcomas into as many sub-classes: (1) round-celled—small, and large; (2) oval-celled; (3) spindle-celled—small, and large; (4) giant-celled; and combinations of these forms—mixed-celled Sarcoma. Alveolar Sarcoma—indicating

STREET LIGHTS IN DENVER

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The principal characteristic of serotons is the presence of the amino group in the side chain. The amino group is usually in the form of a primary or secondary amine. The side chain is usually a 2-phenylethyl group, which is a benzene ring attached to a two-carbon chain. The amino group is attached to the first carbon of this chain. The side chain is usually a 2-phenylethyl group, which is a benzene ring attached to a two-carbon chain. The amino group is attached to the first carbon of this chain. The side chain is usually a 2-phenylethyl group, which is a benzene ring attached to a two-carbon chain. The amino group is attached to the first carbon of this chain.

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ovable, even when they are of small or moderate size, without signs of inflammation, yet tending to produce discolouration of the integuments over them—can scarcely be other than sarcomas." But—it is added—very one of these symptoms may be absent, and yet the disease may be well-marked specimen of sarcoma.

The not unfrequently almost *painless* character of rapidly growing sarcoma might turn aside the diagnosis; leading to the mistake of treating the tumour as a chronic abscess—but for the gradual enlargement of the swelling produced by the accumulation of pus, and perhaps in connection with some obvious caries or necrosis.

The *lymphatic glands* are liable to become infected; some observers assisting very much on this tendency in sarcomatous growths; others, and notably Billroth, affirming it to be "an essential peculiarity of sarcoma, that it does not attack the lymphatic glands, or does so quite late in the disease." The course—he observes—of sarcoma-infection goes chiefly, if not exclusively, through the veins,—not, as in cancer, through the lymphatic vessels.

Ulceration occurs in a variable period. The *sarcomatous ulcer* usually bears the characters of a thickened and upraised border, due to the surrounding infiltration of sarcoma—as in the formation of a cancer-ulcer. Or, without the integument thus being adherent and involved, the substance of the tumour may die in some part, and with it, the overlying portion of integument giving way from pressure, the slough comes out, leaving a deep crater-like chasm, as the ulcer. But this ulceration from within outwards is comparatively rare. It occurs more frequently in cystic sarcoma, as of the breast. The ulceration is then followed by protrusion of the sarcomatous substance from the cyst-wall; the intracystic growth appearing in the form of a fungous mass, protruding through the crater-ulcer. This process of *sloughing* and protrusion continuing, the whole mass of the tumour may at last be enucleated; the sarcoma thus undergoing a spontaneous cure, and without recurrence of the tumour. Rare as this happy issue may be, the gradual subsidence of a sarcomatous tumour, by *atrophic withering*, is still more uncommon, in the history of its structural changes.

Situations.—Sarcoma may be found wherever connective tissue exists; and, therefore, in any part of the body. But certain textures and organs which are more particularly allied to connective tissue, are especially prone to be the seats of sarcoma-production. Thus may be mentioned: the *skin* and *subcutaneous* texture; the *bones*; *lymphatic glands*; *glandular organs*, as the breast or testicle; the upper jaw; the eye; the brain, lungs, or kidneys. Occasionally, the liver, heart, the fascia, and intermuscular septa, the nerves, or spinal cord, are seats of sarcoma. The species produced has some dependence on the parent tissue; round-celled and spindle-celled sarcomas growing in the skin and subcutaneous tissue; and the bones giving birth chiefly to giant-celled sarcoma, although liable to the formation of any species.

ORIGIN.—No *period of life* is exempt from the production of sarcomata. According to Billroth, these growths are rarest in children, and rare between ten and twenty years of age; most frequent in middle life; and rarer again in old age. But sarcoma occurs more often in *childhood*, than cancer; the former being the malignant disease which may be far

more probably met with in early life. Some such growths are *congenital*. Both sexes are equally liable; although the predisposing influence of sex is manifested in the seat of election, as by the production of mammary sarcoma in women. The *constitutional health* of the person is usually good; sarcoma developing in the strong and well-nourished. An apparently healthy, blooming girl may produce one of the most fertile sarcomas, and die in a few months.

Hillroth draws attention specially to the *traumatic* origin of the tumour; that "sarcomata develop with peculiar frequency after preceding local irritations, especially after injuries; cicatrices, also, are not unfrequently the seat of these tumours; black sarcomata may come from irritated moles."

COOPER.—*Structural Changes.*—(1.) Various forms of *degeneration* result in a more or less complete structural metamorphosis of the original growth, mostly attended with *softening*. (2.) Or, a *developmental change* may result in a higher degree of organization, superseding the original structure; the development of fibrous tissue converting it, almost apparently, into a fibrous tumour,—as may be found in fascial sarcoma; cartilage transforming the tumour into the appearance of enchondroma—as in sarcoma of the testis, or of bone; and the formation of bone, giving the characters of an osteomatous tumour,—as often occurs in subperiosteal sarcoma.

(3.) *Combinations* of other tissues with sarcomas may occur in the course of growth; not as the result of organization in the tumour, but from the development of the structure in which the tumour occurs. Thus, gland-tissue associated with the structure of sarcoma, is one of the most common of these combinations, as in sarcoma of the mammary gland. But the tendency of these *mixed* sarcomas is for the sarcoma-elements to supersede and destroy the developed tissue; the sarcoma thus taking its course independently of, and unaffected by, the growth of the organization with which it is associated. The lower life of a morbid, and inferior organization, overrules the higher life of the superior, and healthy organization. The sarcoma, when thus combined, may appear to become cartilaginous, or osseous, or glandular; and in the latter case, eventually acquire a cystic character from the associated gland-tissue, or the changes it undergoes. Thus may cystic sarcoma be formed in the breast, or in the testis.

(4.) The contingencies of *inflammation* and *sloughing*, which befall vascularized growths, may occur in the career of sarcoma. The usual signs of heat, redness, and additional swelling, attend the process of inflammation; the tumour also, which may have been previously tender, now becoming painful. This may be referable to local irritation, or other local injury, stimulating the growth to further activity. Suppuration sometimes ensues, but ulceration more frequently.

(5.) *Secondary formations* are liable, or even prone to occur, in various organs which are also the seat of primary growths. Thus the skin, and subcutaneous texture, lymphatic glands, bones, and muscles, may become affected; and of internal organs, the lungs more especially, the liver, kidneys, spleen, heart, or brain. But other organs are not unfrequently the seat of *primary* sarcoma, appear to possess an immunity to secondary formations; notably, the stomach, and the eye remain unaffected.

(6.) *Recurrence* is always a notable event in the final history of sarcomas. Sarcomata are essentially recurrent growths, sooner or later. The *softer* the tumour may be, in its consistence, and the more rapid the growth, the earlier will the growth return—after its removal. Whereas, the *harder*, and slower-growing sarcomas, return at a later period. Sometimes—observes Billroth—a slowly growing, firm sarcoma is followed by one of rapid growth, but the reverse of this order never occurs. Billroth especially notices the characteristic development of sarcomata in *succession*. The first tumour is completely extirpated; after a time, in, under, or near the cicatrix, a new tumour appears; this also is entirely removed; again, a new tumour appears at the seat of operation, or at a slight distance from it, and near that recurrent growth other new ones; the patient begins to emaciate, possibly lung or liver tumours develop, with their symptoms; and death ensues from suppuration of the recurrent tumour, or from the secondary formations in internal organs.

The course of sarcoma *differs* from that of *cancer*; in the one, regional recurrence predominates—when the tumour has been entirely removed; whereas, in cancer, the recurrence is usually continuous in the part.

The *period of return* is very uncertain; in a few weeks or months only, after operation; or an interval of years elapsing, the reappearance dispels any illusive hopes of a permanent recovery.

Treatment.—Tumours which possess the characters relating to their growth, that distinguish the Sarcomata, and which are more or less prone to recur, after removal, cannot be treated with much prospect of permanent cure. Early and free *excision* affords the only hope—by complete extirpation of the tumour. In a more advanced stage, *amputation*, quite above the seat of the tumour, will be necessary,—when this is practicable. But, although the recurrence of the disease, in the locality of operation, may thus be prevented; the rapid dissemination of the growth in the system, in the course of perhaps only a few weeks, may render operative interference abortive for the prolongation of life.

EPITHELIAL-CELLED TUMOURS.

The **Adenomata** or **Glandular Tumours**, consisting of Gland-tissue, may grow in any Glandular organ or secreting tissue; and thence the more common forms known as Adenoma of the Mamma, and of the mucous membrane,—including out-growths or polypi. Some adenoid tumours also are of a mixed character; consisting partly of gland-tissue with the proper structure of some heterologous Growth; thus producing Adenoma-sarcomata, and other compound Glandular Tumours. Some of these differentiations from the normal type of Adenoma,—a non-malignant gland-tissue tumour—border on Cancer, not only in their structural affinity as Epithelial-celled Growths, but in their malignant characters.

PAPILLARY GROWTHS, in the forms of Corns and Warts, etc., are noticed in connection with Surgical Affections of the Skin.

Cancer comprises *three typical* species of Tumour: Encephaloid, Scirrhus, and, perhaps, Colloid; distinguished chiefly by differences in their general characters of consistence, shape, size, and mobility. Epithelial cancer, as another form of this Growth, is taken separately.

STRUCTURAL CONDITIONS.—The three species of cancer present under

the microscope the same *cell*. This, at first colourless and pellucid, consists of a delicate envelope, containing a large clear nucleus or two, sometimes more, within each of which is imbedded one or two nucleoli, also large and clear. Such is the "cancer-cell." (Bennett.) The cell is of large size, varying from $\frac{1}{800}$ to $\frac{1}{1500}$ of an inch in diameter; and it assumes various shapes; either round, more usually caudate or spindle-shaped; and it presents other forms by out-growths in one or more directions. These cells are deposited in a *filamentous stroma* or mesh-work, which has a variable *alveolar* arrangement and closeness of texture. This intercellular stroma is probably, in most cases, nothing more than the fibrous tissue of the textures, amid which the cancer-cells are infiltrated. At the same time, it may contain some cells, round and spindle-shaped, indicative of new fibroid formation. But another intercellular substance—gelatinous, translucent, and amber-coloured—may be present in more or less abundance, and this is probably peculiar to cancer,—the colloid species, or variety. This colloid matter is itself structureless; but many of the suspended cancer-cells are of large size, owing to their distension with the gelatinous intercellular matter.

Neither the "cell," nor the "alveolar" stroma, are peculiar to cancer; and, therefore, are not histologically diagnostic.

Cancer is essentially an *infiltrating* growth; but while this peculiarity almost constantly prevails in scirrhus and colloid cancers, *encephaloid* becomes *encysted*, about as frequently as it remains free. A very thin, yet distinct *fibro-cellular capsule* may invest this typical form of cancer, and from which thin partitions pass into the tumour thus defined, intersecting its substance, or investing its several lobes. Generally speaking, this capsule is not adherent to the surrounding textures; it furnishes a *matrix* in which numerous and tortuous *blood-vessels* ramify, previous to entering its prolongations and the intercellular fibrous stroma. The vascular network thus distributed around the alveolar spaces, seldom passes inwards among the contained cells. Encephaloid is always abundantly vascular, as compared with scirrhus and colloid, both of which are relatively destitute of blood-vessels. The section of encephaloid is therefore often blood-stained, in the form of spots or patches of extravasated blood, contrasting with the white cancer-substance. *Lymphatic vessels* have been shown by injection in medullary cancer, with regard to specimens of this species in the stomach and liver. The lymphatics accompany the blood-vessels in the intercellular stroma, but they enter the alveoli, as the observations of Cornil and Ranvier have shown. *Nerves* probably exist in the substance of a cancerous tumour; for pain is felt in scirrhus, and less so in encephaloid cancer, when cut into during a surgical operation. This sensibility may be due to the nerves of the part, involved in the cancer-growth.

The leading species of cancer are further allied by possessing a similar *chemical* basis; namely, chiefly albumen, associated with fibrin, gelatine, osmazome, fat, certain salts,—such as the phosphates and carbonates of lime, with the carbonates of soda and magnesia, the oxide of iron, and

As the proportion of cells, or of intercellular matter, prevails, viz (1) *Encephaloid*, or cancer, *par excellence*, abounding heretofore soft, opaque, and of a dead white or fawn colour.

terms cerebiform or medullary, applied to this form of the disease—the cellular or special element of cancer predominating—yields on pressure an abundant quantity of “cancer-juice,” as it is called, resembling milk or cream. (2) *Scirrhus*, on the other hand, is far harder, and therefore *hard* and *craggy*; semi-transparent in a thin section of a bluish-white or fawn colour; comparatively little “cancer-juice” exudes on pressing the cut surface of the fibrous stroma, and this resembles thick gruel than cream, or it may be a small quantity of thin yellow serous fluid exudes; but the fibrous stroma itself remains whereby the cut surface speedily assumes a concave aspect, and the section of any other tumour, which remains level or becomes convex at its margin.

Colloid—in contrast with both the foregoing—is *gelatinous*, owing to the pre-eminence of the gelatinous, intercellular matter, and in which the cancer cells are suspended, the whole being infiltrated through a delicate network of stroma, with large alveoli; it appears, therefore, either as a translucent mass, or a glairy fluid, dimly transparent, and of a greenish-grey colour. This condition of cancer is not now recognized as a species, but as a variety of encephaloid or scirrhus, in consequence of a transformation of a degenerative character.

and Symptoms.—**Tumour and Diagnostic Characters.**—The *encephaloid*, when present, gives a definite outline to an *encephaloid*—*round*, oval, spheroidal, or *lobed*, which contrasts with the indistinct unbounded outline of scirrhus and colloid, the infiltrating character of which is very rarely circumscribed. The boundary of either of these forms of cancer is perceived rather by their degree of consistence, than by that of the textures around the seat of infiltration.

The greater vascularity of *encephaloid*, coupled with its *capsular* and more isolated condition, in many cases, are circumstances favouring the corresponding rapidity of growth, and evolution as a distinct species. Consequently this, the typical species of cancer, frequently attains a large size and *protrudes*; whereas scirrhus remains smaller, rarely exceeding a larger size than an orange, and this rendered indistinct by the softness of the surrounding textures. It shrinks yet smaller by their contraction and absorption, as its abundant fibrous stroma, continuous around, draws texture after texture within the claws, as it were, of the contracting mass. Infiltration penetrates onwards, while contraction draws backwards; so that there is a double action at work—like the action of a glove. Colloid cancer, although ill-provided with blood-vessels, and rapid growth, is scarcely restrained by a contracting fibrous stroma—in this particular resembling *encephaloid*—it spreads to an enormous size, but not as a distinct tumour.

The *circumscribed*, or non-circumscribed, condition of cancer much characterizes it as a distinct tumour. *Encephaloid* is often distinctly circumscribed from the organ or textures in which it is imbedded; while scirrhus can be moved about, only as a diffused mass in connection with the organ to which the cancer has contracted adhesion by infiltration. The chief peculiarities respecting the shape, size, and mobility of the typical species of cancer—in addition to their individual proneness to persistence; and by the concurrence of which characters they are distinguished during life.

The three species—encephaloid, scirrhus, and colloid—may possibly co-exist and be combined in the same growth. Or they may succeed each other, in the same individual. Yet, with all this fraternization, they never lose their individuality; they never become transformed.

Pain may be regarded as an effect, produced, apparently, by compression of the nerves in, and around, the cancer-growth; by separation of their fasciculi and fibrils with interstitial deposit; and, in the case of scirrhus, by dragging of the nerves as the growth contracts. Pain is, therefore, due rather to a *mechanical* operation of the tumour, than arising from any vital endowment of the growth itself, which is in fact comparatively destitute of nerves. *Encephaloid* cancer, in particular, is of this character; the tumour scarcely seeming to be sensitive, when cut into during a surgical operation for its removal. *Scirrhus*, however, seems more especially to give rise to pain from *within* itself, the pain radiating thence along the nerves.

The *kind* and *degree* of pain vary considerably. Lancing pains, particularly when the tumour is handled, are commonly experienced in scirrhus. A hot dart, molten lead, and other such expressions are also to denote both the character and severity of the pain in this species of cancer. The pain of encephaloid is generally less severe; and colloid is comparatively painless. In cases taken indiscriminately the pain differs; a dull aching sensation, a feeling of weight and coldness, distressing itching, represent these varieties.

The pain varies also in point of *date*, *duration*, and *constancy*. Thus it is not generally of early occurrence: being absent in most cases of scirrhus breast, for the first year or year and a half. Its duration is temporary; occurring from time to time, as when the breast is handled. And cancer, not uncommonly, runs through its whole career without any pain. It is absent in about one-fifth of the cases, including all organs and localities. (Walshe.) The pain is usually proportionate to the rapidity of growth; becoming more severe and persistent when the tumour is inflamed or ulcerating or about to slough, and acquiring the hot burning or scalding character.

The *Lymphatic vessels*, and *glands*, proceeding from the seat of cancer-growth become implicated at an earlier or later period, and in various degrees, according to the species of cancer. *Scirrhus*, especially, is thus infective, as shown by the axillary glands when the breast is the seat of disease; *Encephaloid* has the same influence in a lesser degree; *Colloid*, more slowly, and in the least degree; but Epithelial cancer is very constantly infective, in about the proportion of one in two cases, although the glands are not involved to so great a distance from the seat of disease, as in the other species of cancer.

Cancerous lymphatic glands present more or less enlargement and induration, without any adhesion, or discolouration of the skin, at first. But the course of their disease is similar to that of the primary cancer-growth.

Derangements of function are produced, *irritative*, or *mechanical*.

FUNCTIONAL EFFECTS.—The general health may remain unimpaired by the local disease. But, the *growth* of cancer is proportionate to the general health; being temporarily arrested, unaffected or is maintained, and coming into activity as it

es. Thus, with advancing age, there is, so far, a greater liability to r; and particularly of the uterus, during the decline of generative t. In like manner the functional vigour of any part of the body ently protects that part against the production and growth of r; whereas the decline of such vigour has the opposite tendency. , pregnancy and lactation protect the uterus and breasts, respectively; the cessation of those functions is favourable to cancer-growth in organs. The supervention of either of the functions referred to, is, ver, sometimes accompanied with a rapid extension of the disease, a tumour may remain unaffected by these local changes.

achæria is the term used to denote all those functional derangements, y of the circulation, nutrition, and innervation, which together ent the constitutional condition. Feverishness, loss of appetite, a and vomiting, distressing thirst, imperfect digestion, obstinate con- tion or diarrhœa, "*progressive emaciation with peculiar yellow- ness*," muscular weakness, sleeplessness, and melancholy: such are ading phenomena of this condition.

cancerous Ulceration and Ulcer.—The former consists in the ular disintegration or destruction of the structural elements of the res, as in ordinary ulceration, preceded, however, by interstitial ation circumferentially; thus differing from ordinary ulceration. he infiltrating cancer-elements, although themselves dying, seem to se a destructive influence over the proper textural elements.

errhus is inherently disposed to undergo this change, and which is ted in either of two ways: by softening and disintegration of the substance, leading to discharge through ulcerative destruction of egument; or, by cancerous infiltration with adhesion of the integu- to the tumour, resulting in ulceration. Two modes of ulceration, e, may be recognized,—the deep or excavating, and the superficial ve; the former presenting an ulcer which has characteristic nces—those of the scirrhus ulcer; the latter, an ulcer having no characters. *Medullary* cancer evinces less tendency in its sub- ulceration, and comparatively little disposition to infiltration of egument; but the tumour growing more rapidly than scirrhus, the ect to the mechanical influence of mere bulk, yields partly by d attenuation, and partly by common inflammatory ulceration, e sloughing, the aperture thus formed having the characters of y ulcer indisposed to heal. The growth protrudes as a fun- which is liable to repeated attacks of inflammation, with n, ulceration, or sloughing. Hæmorrhage also occurs, from ne, or interstitial extravasations of blood into the cancerous esequently, a protruded encephaloid cancer appears in the ftened and bleeding exuberant growth—*fungus hæmatodes*. in bulk occasionally by ulceration or sloughing, further kes place, so as to overlie and become adherent to the e ulcer, which then appears everted. *Colloid* cancer is indis- erate, although freely infiltrating the surrounding textures. ncer is very prone to ulceration, as will be described in th this species.

resulting from the process of infiltration, and destruction of ts certain appearances which are most characteristic in the

scirrhus ulcer. The *edges*, at first perhaps thin, irregular, and level with the surrounding surface, or sunken, undermined, and inverted, become thickened, elevated, and everted—a condition commonly observed. The *surface*, excavated and irregular, presents *large prominent granulations*, or a base of slough and blood. A thin, greenish, fetid, and acrid discharge—*ichor*—oozes from the ulcer.

A cancerous ulcer enlarges slowly or rapidly, both circumferentially and in depth, the whole area of the textures being infiltrated with cancer-elements. Consolidation increasing, the ulcer becomes firm and fixed, both in its margins and base; *scirrhus* ulcer especially acquires these characters, like this species of cancer in the course of its growth. *Hardness* and *immobility*, therefore, superadded to the appearances of margin and surface already described, render the cancerous ulcer more peculiar.

Cyst-formation.—This production, if not one of accidental association, represents an actual substitution of cysts for cancer-growth, and at the expense of its own structural elements. Thus cysts may either be formed *with* cancer; or from and *out* of the cancer-structures, by their erring development and growth.

The *characters* of the tumour are then those of a solid mass, with circumscribed, fluid tension, in any part which has undergone the cystic change.

Situation.—(1.) *Encephaloid* cancer—the *most* malignant species—selects first, in order of frequency, the *testicle*; next, the *bones*, and particularly the femur; the *eyeball* or orbit; the breast.

Encephaloid cancer is *not* usually *solitary*. It commonly co-exists in many textures and organs.

Melanotic cancer—mostly a variety of encephaloid, by pigmentary degeneration of its cells—is prone to grow first, in or beneath pigmentary moles; or, in organs, it selects first the *liver*.

This variety of cancer occurs as *secondary* formations, in very many textures and organs, simultaneously.

Villous cancer—another variety of encephaloid—is produced exclusively upon membranes; more especially upon mucous membranes, and most of all that of the male *urinary bladder*; next to this the mucous membrane of the stomach, or of the rectum.

(2.) *Scirrhus* cancer selects first the *breast* in the proportion of 95 per cent. (Paget.) Next in order of frequency, the *stomach*; more rarely in the vaginal portion of the *uterus*.

Scirrhus cancer is not unusually *solitary*.

(3.) *Colloid* cancer selects the *stomach* and *large intestine*, the serous membranes, and particularly the peritoneum. In other textures and organs this species is mostly *secondary*.

Colloid cancer is usually *solitary*.

Causes.—*Hereditary* tendency.—Evidence in this direction may be resolved into two general facts. In some families cancer is known to have occurred in more than one individual. On the other hand, to give some force to such observations, some *entire* families are exempt from the disease.

Constitutional tendency to cancer can only be inferred—yet the inference is strong—from the apparently negative relation of this disease to any *external* causes.

other hand, there are reasons for believing that cancer, like primarily *local*, and only secondarily constitutional.

scirrhous tumours spring up in individuals who have always perfect health, and who, to all appearances, are perfectly well at the occurrence of the disease.

These tumours are not unfrequently the result of some local irritation.

Primary cancer-growth is always solitary; never multiple, sometimes rapidly disseminating, as secondary cancer, and thus in different parts.

The constitutional health does not, in the majority of cases, suffer until some months have elapsed; when, as the lymph-glands become implicated, or neighbouring tissues invaded, debility sets in.

If the disease be removed before neighbouring parts have been contaminated, the health, if it have suffered, often improves.

The patient remains free from any recurrence of the disease for a long period, in the great majority of cases.

In some instances, no recurrence whatever takes place, though the cancer has been eradicated from the system, which could not be the case if it were constitutional.

When recurrence having taken place soon after an operation, it is usually either in the cicatrix or in its immediate neighbourhood to cancer-cells which had been widely infiltrated escaping and subsequently developing into a new tumour. Where the disease is constitutional, recurrence would be as likely to take place in the external parts, or in internal organs, as it does when the operation has been delayed.

The same tendency to recurrence after removal, and even to re-deposit in distant organs, is observed in respect to other tumours incontestably, primarily local—*e.g.* myeloid and other sarcomata, and which only become constitutional in their more advanced stages, and in a secondary manner.

Local causes.—*Injury*, or irritation, is not found to have more direct influence on the production of cancer. Thus, scirrhus of the breast seems to have some such origin in less than one case in six; cancer, however, twice as often—one in three cases; colloid is not so in this respect; but epithelial cancer has a traumatic origin most frequently—one in two cases. (Paget.)

RE-RECURRENT OF CANCER, LOCALLY.—This is a very common feature in the vital history of cancer, whether after its separation spontaneous or removal artificially by the knife. The *period* of recurrence is usually early: in scirrhous cancer, under six months in the great majority of cases (Lebert); in encephaloid, about seven months as the rule (Paget); in colloid, a period of uncertain duration; and in sarcoma, the period of immunity may extend to months or years. As a general rule, the rapidity of recurrence is proportionate, not to the duration, but to the rate of growth, of the primary cancer.

The reproduction takes place under different circumstances. (*a.*) The process of cicatrization may not distinctly commence, or be inter-

rupted at an early stage, and fungating growths spring from some part of the ulcer or wound. (b.) A perfect cicatrix forms, and after a variable lapse of time, a tumour grows in the subjacent tissues, presses outwards the newly formed scar, destroys it, and appears externally with the characters of cancer. (c.) In the cicatrix itself, reproduction may occur, by the development of tuberiform cancerous growths. (d.) The lymphatic glands, near to the original cancer-growth, may become the seat of recurrent cancer; as often witnessed after the removal of scirrhus, which primarily affected the breast.

Recurrent cancer is said to grow more rapidly than the primary cancer, but certainly this is not the rule in regard to scirrhus. Less pain and exhaustion attend the recurrent disease, whether scirrhus or encephaloid, than the primary growth.

DISSEMINATION OF CANCER IN THE SYSTEM.—SECONDARY CANCER.—One general law respecting the dissemination of cancer in the system, would seem to be this:—it is regulated, in some measure, by the retention of cancerous matter within the body, or its discharge externally through the integuments by ulceration or through some natural passage. Cancer of the uterus with free discharge per vaginam, is followed by secondary cancer in not more than 25 per cent.; whereas deep-seated cancer of the breast produces secondary cancer in 79 per cent.

The *relative tendency* of the three species of cancer to affect the system secondarily, differs with respect to each. Encephaloid and scirrhus seem to dispute the first place in this aspect of their vital history. But colloid undoubtedly has here the lowest rank, as also in the other characters of malignancy.

Treatment.—Cancer admits of removal, by destruction of the Tumour, or its extirpation with the knife.

(1.) *Sloughing and Enucleation.*—(a.) *By Cauterization.*—This method of treatment is warrantable only in cancer which is already *ulcerated*, and has acquired adhesions beyond the fair reach of the knife.

As compared with removal by the knife, the advantages of cauterization are—the bloodless character of the operation and, consequently, less exhaustion, and the less liability to erysipelas or pyæmia; the disadvantage is, the pain, severe and persistent.

Various caustics have been employed; the concentrated mineral acids, sulphuric or nitric, or the solid caustic alkalies,—potash or lime, and various chlorides, that of zinc especially. Of all these, the glacial sulphuric acid mixed with powdered saffron, forming a black paste, is preferred by Velpeau, particularly in fungoid and bleeding cancers. The caustic alkalies combined, form the well-known Vienna paste. The chloride of zinc mixed with flour readily forms a paste by deliquescence. If a liquid caustic be used, the surrounding skin should be protected by a barrier of gutta-percha or other similar material attached to the skin. If chloride of zinc be used, the skin, which resists this agent, must previously be destroyed by sulphuric or nitric acid.

(b.) *Congelation.*—The continued application of intense cold, is another way of curing a cancer. Pounded ice may prove sufficient; but a salt, nitrate of potash, and hydrochlorate of ammonia, will roughly. The frigorific mixture should be circumscribed by other pliant material, fashioned into a bowl around the

part, with a tube to drain off the fluid as the mixture melts; and the process must be continued for some hours.

(2.) *Excision*, or *amputation*, for the *immediate* removal of cancer, is the treatment most worthy of consideration. Granting the local origin of cancer, and thence the subsequent infection of the system; excision—as distinguished from any *process* of removal—is indicated, and at the earliest possible period. Hence also amputation, where practicable, may be preferable to excision—a partial operation, which may not thoroughly extirpate the disease. The delay of either operation will assuredly allow the infiltrating course and adhesions of cancer to ensue, thereby rendering it locally impracticable or constitutionally useless.

Prolongation of life.—The *species* of cancer affects the estimate as to the average prolongation of life, with and without operation. Thus, in *Scirrhus*, the relative periods may be stated as fifty-two months against forty-eight months, or even a still more advantageous difference (see *Cancer of Breast*); in *Encephaloid*, thirty-three months against twenty months; in regard to *Colloid*, the difference is undetermined; but, in *Epithelial Cancer*, the relative periods are, with operation, fifty-seven months, without operation twenty-seven months, or less than half the duration of existence granted by surgical interference.

The conditions of cancer, or the cases which are respectively favourable and unfavourable for operation, may be stated, approximately, as follow; cancer of the breast being taken as the type:—

(a.) *Favourable* for operation.—(1.) A single tumour, not diffused, and whether in the nipple, on the surface, or in the substance of the breast. (2.) When the nipple alone, or some very limited portion of the skin, is drawn in towards the subjacent tumour. In either case, the integument not being widely infected but simply dimpled, the breast may be removed. But the disease is apt to return in and around the cicatrix. (3.) Ulceration of a cancerous tumour does not preclude operation, if in other respects the case is suitable. (4.) The glands having become diseased to an extent which does not interfere with their removal, is a condition proportionately favourable for excision of the primary tumour. But the state of the glands cannot be exactly determined, otherwise than in the course of the operation, and if then found to be cancerous, they also must be removed; not necessarily, however, at that time, if such an enlargement of the operation might be perilous. Subsequently, and as soon as the health permits, the cancerous glands should be excised. (5.) Amputation of a limb is justifiable, although the glands show some hardening or doubtful enlargement. This rule applies both to the *encephaloid* and *epithelial* disease. (6.) Hereditary tendency, strongly manifested, does not entirely prohibit operation. (7.) Recurrent cancer may be removed under the same restrictions, as with reference to a first operation. (8.) Age does not prohibit the removal of a growing cancer.

(b.) *Unfavourable* for operation.—(1.) Certain constitutional conditions—*e.g.* cancer co-existing, especially in some internal organ, or marked cancerous cachexia, albuminuria, or other grave organic disease. (2.) Diffused cancer and persistent œdema. But the latter condition is significant only when circumferential; œdema remote, depending on obstruction to the circulation at the seat of disease, *e.g.* œdema of the hand from cancer of the arm, is not itself a prohibitive condition. (3.)

Adhesion, if at all extensive, either of the skin, or subjacent textures, is decidedly prohibitive of operation. (4.) Ulceration, otherwise than to a very limited extent and depth, is equally so. (5.) Cancerous tubercles in the skin over a cancer, is a condition even more unfavourable for operation. (6.) The glands having become diseased to an extent which interferes with their removal, prohibits also removal of the primary tumour, either by excision or amputation. (7.) Rapid growth, in any way, is decidedly unfavourable for operation. Hence most encephaloid cancers are better left alone, unless in a very early stage. (8.) Cancers, the relations of which to important parts around cannot be foreseen, are better not meddled with. Thus circumstanced, are cancers beneath the scalp, which often implicating the bone, penetrate the skull; cancer of the eye, which often involves the optic nerve; cancer of either jaw, particularly the upper, where it is apt to protrude into the maxillary sinus or the ethmoid cells; and cancers about the root of the neck.

Epithelial Cancer.—Epithelioma.—STRUCTURAL CONDITION.—This variety consists essentially of cells or scales, resembling those of scaly epithelium, infiltrated among the component elements of the skin or mucous membrane, or sometimes among the textures of internal organs. Whatever portion of the skin or mucous membrane may be thus affected, the *epithelial cancer-cell* or scale has very much the same characters. It is flattened, of an irregular outline, with usually a prolonged diverticulum at some point of its margin, and of a variable size, averaging $\frac{7}{100}$ of an inch in diameter. It contains pale *molecular matter*, converging towards a *central nucleus*, which is clear, bright, and well defined, round or oval, and *very small in comparison* with the cell; more uniform also in its shape and size. This *nucleus* is usually *single*. It may contain two or more *minute granules*, but rarely a bright distinct nucleolus.

Associated with these cells, are what Paget calls "brood-cells," or endogenous cells. They present many varieties of appearance, which may be regarded as the results of one or more nuclei, enclosed within cells, assuming, or tending to assume, the characters of nucleated cells.

The "globes epidermiques" of Lebert—"laminated capsules," Paget—are the most singular and characteristic structures of epithelial cancer, yet *not peculiar* to this disease; nor are they, apparently, special structures, for they consist of epithelial scales. These capsules are very large and spherical cysts, containing granular matter, nuclei, and roundish epithelial cells, clustered so as to almost appear as if fused together; the peripheral portion consists of epithelial scales, superimposed in successive layers, thus forming a laminated capsule.

Such are the structural elements of epithelial cancer. They are found *infiltrated*—principally in the substance of the skin or mucous membrane—but not uniformly diffused throughout the component textures of the part affected; with more or less *fibroid stroma*, forming a network between the cells, but *not* having the open, *alveolar* arrangement for the reception of cells in groups, which distinguishes other species of Cancer-Growth. Physical characters, on *section*, are also characteristic. The *sub-* yellowish-white colour, and hard or firm but friable, and a little cancer-juice, but a thicker, yellowish, cheesy

The cancer-cells may predominate in the *corium*, forming a swelling very slightly elevated above, or imbedded below, the proper level of the integument, and the depth or thickness of which is much less than its dimensions laterally; or these cells may predominate in the *papillæ*, presenting a prominent warty or exuberant out-growth; or, the *sub-integumental* texture may be their chief seat, forming a deeper-seated, flat, or rounded mass.

Of these varieties, the first two may be named the *superficial* or out-growing; while the third is the *deep-seated* form of epithelial cancer.

It must not be forgotten, however, that these distinctions are more *apparent* than essential. Their value consists in reference to the earliest diagnosis of this disease, in whichever form it may chance to make its first appearance. For subsequently, an epithelial cancer which was superficial or exuberant, is prone to extend into deep-seated parts; and one at first deeply seated may grow out exuberantly. Moreover, when ulceration is progressing, a greater uniformity of external appearance is found; because, in general, while all that was superficial or exuberant is being destroyed, the base of the cancer is constantly extending, both widely and deeply, into the sub-integumental tissues.

DIAGNOSTIC CHARACTERS.—In the *earliest* appearances of epithelial cancer, the following are most *diagnostic*.

1. Of the *superficial* or *out-growing*, prior to ulceration, they are these:—

(a.) An *outspread* swelling arises—say on the lower lip, labium-pudendi, or scrotum; and an unnatural firmness or hardness of the affected skin is perceptible; but the superficial dimensions much exceed the thickness of this swelling. Its outline is round, oval, or sinuous; and its surface, sometimes nearly smooth, is more often *coarsely granulated*—like that of a syphilitic condyloma—deriving this appearance from the enlarged and closely clustered papillæ. Generally, the surface is moist with an *ichorous discharge*; it may, however, be covered with a *scab*, or encrusted with a *soft substance*, consisting of detached *epithelial scales*. In most cases; the part is unduly *sensitive*, and *injected with blood*.

When the *papillæ* become infiltrated, they constitute the *cauliflower-like* mass so characteristic of the ordinary form of epithelial cancer. This mass looks very vascular, is moist with ichor, and covered with pasty cakes of epithelial scales, which beset the interstices of the enlarged papillæ.

(b.) Occasionally, the shape of an out-growing epithelial cancer is that of a *sharply bordered circular or oval disc*, upraised a little above the level of the adjoining skin, or mucous membrane, and imbedded to about the same depth below it. The *surface* of this disc—usually *flat* or slightly *concave*—is granular, spongy, or irregularly cleft; and its *margins* are surrounded with healthy texture, which becomes raised and often slightly everted by their enlargement—*e.g.* many epithelial cancers of the *tongue*.

(c.) Sometimes, epithelial cancer grows out in the form of a *cone*.

(d.) Lastly, the out-growing form of this disease may be a *narrow-stemmed*, and possibly pendulous, growth from the skin.

These and other shapes of superficial epithelial cancer resemble somewhat the appearances presented by warty and condylomatous growths;

but they differ essentially in respect of their minute structure;—being infiltrations of the skin and papillæ with epithelial cancer-cells; whereas the structure of warty growths remains healthy, however strange may be the appearance they assume.

(2.) *Deep-seated* epithelial cancer is generally (a) an *advanced stage* of the superficial; for by progressive infiltration, the subcutaneous or sub-mucous tissues are invaded; (b) but this variety of the disease may occur *primarily*, although comparatively rarely; as recurrences of the disease, near the seats of former operations, or as secondary deposits about the borders of primary superficial growths.

ULCERATION.—(1.) Ulceration of *superficial* or out-growing epithelial cancer, primarily appears as either a diffuse *excoriation* of the whole surface of the cancer, except its borders; or else a shallow ulcer limited at first to some fissure where the disease commenced. The discharge from this excoriated or ulcerated surface dries into a thin *scab*, or a thicker and darker crust; which conceals for a while the ravages of ulceration, still slowly extending beneath,—downwards and outwards.

(2.) Ulceration of *deep* epithelial cancer begins in one of three ways:—In some cases, the superimposed skin or mucous membrane having become *adherent* and thin, cracks; and this condition may remain stationary for a long while, in the form of a *dry dark crevice*; but usually ulceration, commencing from this point, extends into the mass of the cancer.

In other cases, the substance of the cancer having become inflamed, it softens, suppurates, and discharges its contents through an ulcerated opening, or a long rent; leaving a *cavity* which speedily assumes the characters of an ulcer, and extends peripherally.

In a third series of cases, and, perhaps, especially in secondary formations, and in those under the scars of old injuries, the cancer *protrudes through a sharply bounded ulcer* in the sound integument or scar, growing exuberantly, with a soft shreddy surface, like a medullary cancer, or with a firmer, warty, or fungous mass of granulations.

Dissimilar as are the earliest aspects of ulceration in both forms of epithelial cancer—out-growing and deep—they gradually assume a uniformity of appearance which is very characteristic.

COMPLETE ULCER.—An *excavated sore*, of a round or oval shape, presenting a *roughly granular surface*, which has a brick-dust red colour, and oozes a stale-smelling discharge. This surface bleeds easily, although not freely. The textures surrounding its *base and borders* become indurated and rigid, as they progressively become more and more infiltrated with cancer-cells. The ulcer thus acquires a remarkable degree of immobility, and its *margin* protrudes in the shape of a thick everted ridge, well defining the boundary of the ulcer. Infiltration increasing, the marginal ridge forms an *irregular nodular belt*, which overhangs the base of the ulcer, and gives an undermined appearance to its everted borders. The skin of the surrounding skin are more particularly the seat of ulceration, then a *warty* rather than a nodular belt springs up. With all these signs of progressive infiltration, followed by the work of destruction is not stayed below the *base* of the ulcer. It *spreads deeper and deeper*, sparing no texture, and the vessels, which hold out against the invasion of most other

forms of ulceration, if indeed they do not escape altogether. But arteries of the first magnitude yield to the unsparing ravages of epithelial cancer.

Pain, varying in kind and intensity, such as burning or neuralgic pain, attends the course of ulceration. The *lymphatic glands* are infected at an early or later period, according to the rapidity of the disease; and involving the proximate glands, which become enlarged and somewhat indurated, the disease extends to other glands, yet not so far as in other species of cancer. Thus, when the lip is the primary seat of disease, the cervical glands are secondarily affected; while the lumbar glands show the extension of disease from the penis or scrotum. Internal organs are far more rarely infected than from any other species of cancer. Cachexia is neither early nor well marked; nor in any way peculiar.

Situation.—Epithelial cancer selects either the skin or subcutaneous texture; or the mucous membrane. (1.) Its chosen seat is the *lower lip*, at or near the junction of the skin and mucous membrane; then the *prepuce*, *scrotum* of chimney-sweeps; the *nymphæ*, the *tongue*. (2.) Occasionally in very many parts; the interior of the cheek, upper lip, mucous membrane of the *palate*, *larynx*, *pharynx*; neck and orifice of the *uterus*, *rectum*, and *urinary bladder*; skin of the extremities, the face, head, and various parts of the trunk. (3.) In yet more rare instances, as a primary disease, it occurs in other than integumental parts; as in the inguinal lymphatic glands, in bones, in tissues forming the basis or walls of old ulcers. By *extension* from its original seat, this growth may involve many deeper textures; fasciæ, muscle, bones; and as a *secondary* disease it may, but very rarely, supervene in internal organs—the lungs, liver, heart, spleen, or kidneys.

Epithelial cancer, as a primary disease, is usually *solitary*. Occasionally, two or more co-exist, and even in the same part, as on the prepuce and glans. Eventually, secondary epithelial cancer-growths form in the tissues surrounding the primary and parent growth.

Causes.—*Predisposition* to the production of epithelial cancer increases, as age advances, the proportionate liability rising with each *decennial period*. Billroth estimates the period of greatest liability to be from the *fortieth to the sixtieth year*, rarely later; but sometimes the disease appears in childhood. *Males* are more often attacked than females. *Hereditary* predisposition would seem to be traceable in members of the same family.

External Causes.—(1.) Previous injury of the part is often predisposing. But the injury is generally some slight and oft-repeated damage, as by frequent blows or friction, thus amounting to *prolonged irritation*. The habitual smoking of a clay pipe, as affecting the lip, and the irritation arising from soot lodged in the crevices of the scrotum, are familiar examples of the external causes of epithelial cancer. It is often seen to proceed from a crack or fissure, to appear in the form of a small hard knob, lump, or scabbing wart. (2.) Some *chronic morbid condition* of a part may become the seat of the disease; as a *cicatrix*, especially when exposed to injury; or, it has been known to supervene on a patch of old-standing *cutaneous eruption*—apparently chronic eczema.

Sometimes advancing slowly, in a year it gains only the fraction of an inch on the part around; or spreading rapidly, in a few months it invades to the extent of several inches. The *deep-seated* form of growth is also more malignant than the superficial or out-growing.

Treatment.—The guiding indications of treatment in respect to epithelial cancer are two; one or other of which is always practicable.

(1.) To superinduce inflammation and sloughing, thus destroying the cancer. This may be accomplished by caustics, such as those already mentioned for the destruction of cancer generally; the strong mineral acids, caustic alkalies, and chloride of zinc. But it must be confessed that this method of treatment is not more successful in the one case than the other.

(2.) Removal of the cancer is the most effectual treatment. This may be accomplished by excision, ligature, or amputation.

The former method is, generally, most eligible; care being taken to cut sufficiently wide for the entire extirpation of the growth. It will be necessary to include any neighbouring lymphatic glands which have decidedly become secondarily affected by the cancerous infiltration. But the strong infiltrating tendency of epithelial cancer renders its effectual removal by excision doubtful. Removal by ligature, or the *écraseur*, is the alternative method; wherever excision is impracticable, or would be imprudent, or inefficient.

Amputation is necessary, primarily or secondarily, in certain cases. It may be so, in the first instance, owing to the extent of the disease, or its locality, as when situated on the leg, or the arm, near the trunk.

Recurrence of the disease after apparently complete removal by operation is, I believe, the rule, without exception. And the epithelial growth returns sometimes in the cicatrix, sometimes in the lymphatic glands, when previously healthy; or occasionally in some distant part or internal organ. The period of recurrence varies considerably; being very early, or much longer after operation,—a year and a half, possibly to five years, or an indefinite time. But the *prolongation of life* is a very advantageous consideration. The average duration after operation is nearly five years,—thereby granting a period about twice as long as without operation, or an additional two years and a half, as the advantage gained by timely surgical interference.

Cylindrical or Columnar-celled Epithelioma.—This variety of Epithelial Cancer is so named from the shape of its essential cell-element—columnar epithelium, as distinguished from squamous epithelium in the other form of Epithelial Cancer.

Columnar epithelioma affects some portion of *mucous membrane*. The growth consists of *irregular tubules*, lined with *columnar cells*, forming one or more layers within the tubules; between which there is a variable amount of connective tissue—an *intra-tubular stroma*. The arrangement of the epithelium may so nearly resemble that of a normal gland-tissue, as to render it most difficult to distinguish a columnar-celled epithelioma from the structure of a columnar-celled adenoma. Hence, the epithelioma in question has been sometimes misnamed *adenoid* or glandular cancer.

This growth may occur in various parts of the whole tract of mucous membrane; it is especially the cancer of the *gastro-intestinal mucous membrane*, and is produced in the *rectum* particularly, as the most common situation; sometimes in the ducts of secreting glands, as of the pancreas; but it may appear also in the uterus, or within the *nasal fossæ*, or the *antrum*.

The growth increasing, forms a more or less *raised tumour, whitish—*

or dark red, when highly vascular—and of soft consistence; it presents a granular or papillary surface; or, with soft and long processes, it has more of a villous character. Usually diffused, the tumour is sometimes sharply defined and encapsuled—in facial columnar epithelioma. It gradually infiltrates adjoining textures, thus attaining perhaps to a considerable size, and tends to ulcerate early. In the face, the tumour may thus appear through an ulcerated opening in the skin. The bones become eroded, without any osteophytic reproduction.

When ulceration has supervened, the pristine appearance of the tumour is more or less effaced; the growth being lost in the extensive ulcer. In the course of growth, the lymphatic glands may become infected, although this is not a marked feature in the vital history of columnar epithelioma; and facial epithelioma of this kind—according to Billroth's observation—is never attended with lymphatic infection. But, secondary formations in internal organs are not uncommon, especially in the liver, as the disease becomes disseminated.

TREATMENT is the same as for squamous or cutaneous epithelioma; and early operative interference is more hopeful, when the disease occurs in a locality which admits of its complete removal, as in the face.

CHAPTER III.

ULCERATION AND ULCERS, GANGRENE AND MORTIFICATION.

DEATH of any part of the body, as contrasted with its nutrition, is essentially a disintegration of the constituent elements of structure and resolution in molecular matter; the destruction of the organization which resulted from development; the falling to pieces of that which the formative power had constructed.

Degeneration—usually fatty, precedes the disintegration when consequent on inflammation.

Ulceration, and Mortification including Gangrene, are essentially processes of Disintegration and textural death. But the pathology of these processes, and their differences in degree only, should be clearly understood.

Ulceration as a disintegrative process is generally of inflammatory origin. The molecular matter resulting from ulceration may disappear in either of two ways:—

Firstly. By discharge, in the liquid form; thus leaving a chasm or ulcer.

Secondly. By absorption through the lymphatics and veins jointly, especially the former vessels; thus leaving a chasm or ulcer.

Possibly, both modes of removing the disintegrated textures co-operate in ulceration.

DIAGNOSTIC CHARACTERS OF ULCERS.—An ulcer differs widely in appearance. Ulceration forms a chasm of very variable extent and depth, from the slightest abrasion of the integument to the deepest cavity down

to and into the bone; its shape circular, crescentic, or irregular; it is found less frequently bare, than accompanied with sloughy portions of tissue, or with *granulations* of some description, overspreading the whole or part of the surface. The circumferential *margin* of the ulcer varies in thickness, and in direction; being turned inwards and perhaps undermined, everted, irregular, or tolerably even; it may be hard or soft; its colour and that of the surface may be red, dusky brown, livid, or otherwise shaded; while the *ichor* or *discharge* varies greatly in quantity and quality from the typical characters already stated (p. 14), through every description of mixed discharge, replaced by healthy pus. The *integument* around may be healthy, inflamed, indurated, œdematous, or show pigmentary discolouration.

CAUSES.—All these different appearances proceed, generally, from *constitutional* conditions, as scrofula, scurvy, syphilis; but, occasionally, they are produced by *external causes* acting locally on the part; as by friction, continued pressure, filth, or various topical applications and dressings of an irritant character.

Two classes of ulcers, therefore, each including subordinate varieties, might be recognized with reference to their etiology; but, practically, it would be difficult to draw this line of distinction.

The *course* of ulceration is either that of progressive extension, in surface and depth; or that of healing by suppurative granulation and cicatrization, as the mode of reparation. (See Reparation by Granulation in Contused and Lacerated Wounds.)

TREATMENT.—Two general indications may be mentioned for guidance in the treatment of all ulcers; namely, to arrest disintegration, and to induce reparation. Local treatment comprises chiefly: rest and elevation of the part—in most cases, applications of a stimulant, astringent, or sedative character, and bandaging—for pressure, in some cases, or simply to retain the dressing. Constitutional treatment will have relation to the causes of ulceration, which are mostly states of the general health.

The following species present, perhaps, the most distinctive characters:—

(1.) Healthy or typical Ulcer. (2.) Inflamed. (3.) Irritable. (4.) (Edematous. (5.) Indolent, and Varicose. (6.) Phagedænic. (7.) Hæmorrhagic. (8.) Scorbutic. (9.) Scrofulous. (10.) Cancerous. (11.) Lupoid. (12.) Rodent. (13.) Syphilitic.

(1.) **Healthy or Typical Ulcer** may be consequent on a wound or other injury, or the separation of a slough; and the opened sore thus formed, in a healthy person and itself in a healthy state, will be known by certain characters. Of variable extent, depth, and shape, the *surface* is uniformly mammillated with small florid granulations, which, however, do not bleed readily and are not painfully sensitive. Healthy *pus*, opaque, yellowish, and of creamy consistence, more or less in quantity, bathes the granulating surface. The *margin* of this ulcer shelves gently down to its base, and is scarcely perceptibly harder than the adjoining healthy skin. The *new skin*, corresponding to the margin, has an opaque white colour, and its formation is preceded by a linear translucent film of cuticle, which, veiling the subjacent granulations, has a bluish-white tint. The granulations immediately within this line are more florid than those nearer to the edge of the ulcer, because more vascular where the cuticle and skin are being formed.

The *histological* or *textural condition* consists of an abundant emigration of cells, infiltrating the connective tissue around the ulcer, and at the base of the granulating surface, where these wandering cells become granulation-cells, some of which pass off as pus-cells. There is also an increased development of *vascular loops*, especially in the papillae around the margin of the ulcer, where the granulations are most vascular and florid; and the *papillae* are themselves enlarged. Around the margin of the ulcer, the *dermis* is thickened, and perhaps indurated, forming a somewhat raised border, shelving down to the thin bluish-looking line of circumferential *w* cuticle.

The surface having reached the level of the skin, by granulation, and the formation of pus—superfluous organizable material—having ceased; cicatrization proceeds inwards by the continued formation of marginal skin, succeeded by cuticle, and thus, at length, exhibits the characters of healthy skin, in the recent state. (See also *Reparation by Granulation*.)

TREATMENT.—Little or no positive treatment is requisite, a healthy ulcer healing spontaneously, provided any circumstances adverse to the process of reparation be excluded. Rest, position, to prevent tension and any undue determination of blood, and protection of the surface by water-proof dressing, are sufficient.

Skin-Grafting may be here noticed; a principle of treatment due to M. Reverdin, whereby the cicatrization of a granulating surface may be completed, and in a much shorter period than from the circumference alone; as when the ulcer is of large size, or indolent; or in order to prevent attraction of the cicatrix, as after burns, which would result in deformity and functional inutility of the part. But, it is essential that the ulcer be a healthy granulating surface, and which has commenced to cicatrize. Any ulcer induced, or maintained, by constitutional disease, is inherently unfit for skin-grafting.

The procedure of skin-grafting will be readily learnt by the Student in the course of his Dressership.

(2.) **Inflamed Ulcer.**—A departure from the healthy type of ulcer; the usual signs of inflammation are characteristic. An *area of redness* with some *swelling* around the ulcer are more or less conspicuous appearances, while a burning heat and aching pain are experienced, particularly when the part is pendent, as the shin—a common situation for an inflamed ulcer. The granulations have a rose-red rather than a florid colour, or they may be absent and the surface of the ulcer overspread with a thin ash-grey scough; the suppuration is scanty, thin, and perhaps tinged with blood. As inflammation subsides, the cuticle peels off or desquamates for some distance round the ulcer.

When, in the course of an inflamed ulcer, sloughing becomes the prominent feature, and the ulceration enlarges in this manner, it may be properly named,—a *sloughing* ulcer.

CAUSES.—This condition of sore accompanies inflammatory fever, an ulcer previously healthy then becoming inflamed; or it may be produced by external violence or consequent on local irritation.

TREATMENT.—Any cause or causes in operation will, as usual, primarily direct the treatment, namely, their removal. Then, *local* applications are those appropriate for inflammation. A poultice, or a cold evaporating lotion, if more agreeable, and perhaps the local abstraction of blood by a

few leeches applied in the neighbourhood of the ulcer; with rest and an elevated position of the part; and, finally, water-dressing as the sore assumes a healthy character, and undergoes the process of healing. Bandaging the limb may, at this period, be useful to support the weakened vessels of the part; and thus prevent any liability to the continuance or recurrence of a low state of inflammation; a very troublesome *chronic* condition, which is apt to follow an acutely inflamed ulcer. The *constitutional* treatment should be more or less depletory, by a combination of saline aperients, diuretics, and diaphoretics, aided by a moderated diet. Subsequently, when the ulcer may have assumed a *chronic* form of inflammation, the general health will need to be supported by tonic and stimulant treatment, including dietetic resources.

ECZEMATOUS Ulcer, so called, is simply a variety of the inflamed ulcer; the *surrounding skin* presenting the usual red appearance, with the punctiform and vesicular character of eczema. When the vesicles burst, the surface becomes raw, and exudes a yellowish, serous discharge, which is very acrid and irritating. This species of inflamed ulcer may occur in debilitated subjects—young or old; but it is liable to be provoked by some irritant dressing, even of an antiseptic kind, when probably the constitutional predisposition to eczematous inflammation co-exists.

The *treatment* should have regard to the *constitutional* condition; by the administration of such tonics as quinine and iron, with careful attention to diet, and the state of the digestive organs. Sometimes, a scrofulous or gouty tendency will indicate the appropriate course of treatment. *Topical* measures comprise various stimulant, astringent, and sedative applications to the ulcer, and surrounding area of eczema; as by painting the surface with a strong solution of nitrate of silver; or dressing it with boracic ointment; while, the distressing heat and itching may be allayed by means of conium or belladonna extract, in the proportion of a drachm to the ounce of ointment. Scrupulous cleanliness must be observed in dressing the ulcer.

(3.) **Irritable Ulcer**.—This variety of ulcer is to be distinguished from an inflamed ulcer, with which it might be confounded. *Painful* to a degree, even of a neuralgic character, the other and more peculiar signs of inflammation, particularly circumferential redness and swelling, are wanting. The *granulations* are imperfect or absent, reddish here, tawny there; but they are very painful and sensitive to the touch, and readily bleed on slight pressure or the application of a stimulant dressing. The discharge is thin and sanious; and the *edge* of the ulcer, irregular, sharp, and abrupt, evincing no disposition—not to say an obstinate indisposition—to commence cicatrization.

Commonly situated on the shin or lower part of leg, this ulcer is generally connected with some disturbance of the *digestive organs*, and with constitutional irritation as distinguished from inflammatory fever. More rarely, some cause of *local irritation* may co-operate; as the passage of feces and the contraction of the sphincter ani muscle with regard to the ulcer in ano.

TREATMENT.—The removal of any cause in operation is the primary *step*. Hence the rectification of the *constitutional* disorder, as by *purgatives* and mercurials to influence the secretion of bile. Therapeutically, will do much to allay the general irritability. Of

typical applications, nitrate of silver freely applied is the most efficacious. Lead and opiate lotions may be recommended. Rest of the part, as in the treatment of other ulcers.

(4.) **Cedematous Ulcer.**—In this variety, sometimes named the *weak ulcer*, the *granulations* are large, pale, translucent, and flabby, sometimes *cropping up* as large gelatinous masses above the level of the sore. The discharge is watery, and the margin has no disposition to commence cicatrization. Indeed, the granulations are apt to slough.

This condition arises in connection with a weak circulation, or malnutrition; or it may arise from some local cause of defective nutrition, or proceed from the soddening of an ulcer by continued poulticing or other prolonged application of moisture and warmth.

Treatment.—Local treatment is often remarkably curative. An elevated position, astringent lotions, as of sulphate of zinc or copper, or nitrate of silver, and the support of a bandage, will probably succeed in reducing the granulations to the level of the ulcer, when exuberant, and strengthen their vitality, thus favouring cicatrization. But in using these appliances, it is important to remember the perishable nature of cedematous granulations. Consequently, the astringent solutions should be weak, either of the sulphates being used in the proportion of about two grains to the ounce of water. And the bandage must be applied with even and gentle pressure. In conjunction with local measures, a *tonic* and *nourishing* plan of general treatment will aid in imparting a healthy character to the ulcer. The mineral acids especially, with cinchona or cascarilla bark, may be given.

(5.) **Indolent, or Callous, and Varicose Ulcers.**—A deep and, perhaps, large excavation, presenting a *flat surface*,—without granulations, of a dusky or pale colour, scarcely sensitive to the touch nor disposed to heal, and having a firm, *hard base adherent* to the subjacent fascia. A thin offensive discharge exudes. The *edges* are everted, thick, and callous, and of an opaque-white colour, owing to accumulated epidermis; the *surrounding integument* to some distance is congested, of a dusky hue, and pigment-stained, thickened, hardened, and bound down to the textures beneath. Such an ulcer is obstinately indisposed to heal. It is commonly located on some part of the leg.

An ordinary—non-specific—indolent ulcer does not seem to be dependent on any constitutional disorder; but it is apt to occur in weakly, ill-nourished, and perhaps ill-fed persons.

The **Varicose ulcer** is a variety of *indolent* ulcer, and so named from its connection with the varicose condition of the adjoining veins. Situated in some part of the leg, commonly on the inner side towards the ankle, and single; in the recent state it is of small size, ovoid shape, and with its long axis in the direction of the limb; without granulations and firm, a *bluish-purple colour* of the base and more so of the margin and adjoining integument will be noticed, and the ulcer is not unfrequently painful and sensitive. Inflammation and sloughing, or other conditions, may temporarily veil these appearances; but the *tortuous, knotty enlargement* of the *venous trunks*, or the more diffused mottling of smaller varicose veins, with, perchance, a *brownish-red pigment-stained skin* around the ulcer, is still a characteristic accompaniment. In the progress of varicose ulcer, an occasional event of practical importance is *venous hæmorrhage*; arising

from the ulceration having penetrated an enlarged vein, it may occur suddenly and copiously.

TREATMENT.—An indolent ulcer cannot cicatrize so long as it and the surrounding integument are both bound down; the margin being upraised and retracted, and the base depressed. Accordingly, *pressure* and *stimulation* together, represent the plan of treatment. *Methods.*—The nitrate of silver freely applied to and around the ulcer, or the continued application of zinc ointment, with tolerably firm bandaging, may bring it into a healthy condition. But in this kind of ulcer particularly, iodoform has a most beneficial influence, apparently as a stimulant. The yellow crystals may be sprinkled on the surface of the sore, or applied in the form of an impregnated gauze. It is apt, however, sometimes to induce symptoms of poisoning by iodine, especially in childhood, or when the surface is extensive. The effects of this agent must, therefore, be watched, and it may have to be discontinued, as it has occasionally proved fatal. A more even and constant pressure is secured by *strapping* the limb with strips of linen spread with soap-plaster, mixed with a little adhesive plaster to fix it. Drawn around the limb, from the side opposite the sore, each strip in succession should partly overlap the preceding one, and the ends be crossed obliquely; thus forming a compact casement, and which should extend two or three inches above and below the sore. This is known as Baynton's method of strapping. The strips should be changed every other day, to remove the discharge; but when the integument has become softened and loosened, so that the sore is beginning to heal, the strapping may be allowed to remain for a week at a time. The *india-rubber* bandage, introduced by Dr. Henry Martin of Boston, is specially serviceable, in affording an even and maintained support to a varicose ulcer.

Blistering circumferentially, softens and loosens the integument, and may thus tend to facilitate cicatrization. The *actual cautery* is recommended by Billroth, to induce purulent inflammation, or to destroy the callous edges entirely. A *warm-water bath*, according to Zeis's practice, has proved very efficacious in softening the dry hardened borders of the ulcer. *Incisions* have been recommended to allow the granulations to contract; and, in most obstinate cases, transplantation of a portion of adjoining healthy integument, sufficient to close in the ulcer, may be tried, with the view of forming a substitute cicatrix. Of these resources, I am decidedly in favour of blistering.

Opium seems to have some special influence in rendering the granulations florid, and promoting the healing of an indolent ulcer. It is therefore advisable to keep the system under this influence by the repeated administration of opium, in small doses. At the same time, the aid of *stimulants*, *tonics*, and a generous *diet* should not be overlooked.

The *Furuncular* ulcer is amenable to the same plan of treatment; but the state of the veins, as the apparent cause in operation, is an important consideration, and the special object of treatment. An *elevated position* of the limb to relieve congestion, and an *elastic bandage* or *stocking* to compress the vessels, will prove sufficient for this purpose, in most cases. In more obstinate cases, and with the view of a *permanent cure* of the veins must be resorted to. Of the various means resorted to in the treatment of *Varicose Veins*—the safest and

successful is that by *subcutaneous section* of the veins; with the application of a *twisted suture*, for compression, on either side, to stop any communication with the circulation.

Passive hæmorrhage, occurring in the course of a varicose ulcer, is arrested by a compress of lint, secured by a bandage, over the point in the vein which has given way; and by elevation of the

1) **Phagedænic Ulcer.**—Essentially a spreading ulcer, it is characterized by *dusky red discolouration* and *swelling*, with perhaps pain around the ulcer; a greyish, glutinous or slimy slough, which has a peculiar fetid odour, occupies the surface of the sore, and the sharp, irregular as if worm-eaten, and undermined, fall away; thus enlarging and deepening the area of the ulcer. *Sloughing* predominates in such ulceration, and hence sloughing and phagedænic are not uncommonly associated.

Former or latter, constitutional disorder ensues; irritation rather than inflammatory fever, with great weakness and exhaustion.

Even as this ulcer is, in its local and constitutional characters, totally different from gangrene, it would seem that phagedænia arises from an external *contagious matter* applied to a sore; the constitutional disorder is secondary and symptomatic, although in its turn affecting the ulcer. On the other hand, habitual deprivation of food, the *abuse of stimulants*, indulging on spirits, and, perhaps, overcrowding, with *destitution*, seem to give rise to phagedænia.

TREATMENT.—To arrest the rapidly spreading ulceration, a free application of *strong nitric acid*, by means of a glass brush, is most useful. Followed by poultices, the slough, thus formed, is detached, exposing probably a healthy surface, which has acquired a healing tendency. Re-application of the acid may be necessary, or the continued application of yeast, charcoal, or chlorinated poultices may be sufficiently antiseptic and cleansing; and, at the same time, disinfectant. *Opium*, administered in small and repeated doses, so as to keep the system under control, is most potent in allaying the irritative fever; while the freedom of the circulation and healthy nutrition are restored by *quinine*, *laxative acids*, and a generally nourishing diet.

2) **Hæmorrhagic Ulcer.**—Any variety of ulcer may assume this character, but some more particularly—*e.g.* the irritable, phagedænic, or cancerous ulcers—by the penetration of a blood-vessel; and the venous ulcer, by passive hæmorrhage owing to the blood-condition. Frequently, an ulcer oozes blood about the catamenial period, and especially in women suffering from amenorrhœa; the hæmorrhage then characterizes *menstruation*. An ulcer thus acquires a bloody, clotted appearance.

TREATMENT.—Arising from such various causes, a hæmorrhagic ulcer is a contingency rather than any special variety of ulcer, and should be treated accordingly in connection with whatever ulcer it may be associated, reference to the particular condition, local or constitutional, which characterizes the hæmorrhagic character.

3) **Scurbutic Ulcer.**—Ulcers or sores of any kind already existing from other causes assume, in consequence of the scorbutic taint, a more peculiar character, and when thus modified have usually been

termed "scorbutic ulcers." Any such ulcer is distinguished by its *livid colour*, and irregular *tumid border*, around which no trace of cicatrization is evident; whilst the *surface* of the sore is covered with a spongy, dark-coloured, strongly adherent, fetid crust, whose removal is attended with free bleeding, and is followed by a rapid reproduction of the same material. This crust, in bad cases, attains to a "monstrous size," and constitutes what has been named by sailors "bullock's liver."

TREATMENT.—Regarding a scorbutic ulcer as but a manifestation of scurvy, its apparent dietetic cause is the deprivation of fresh vegetables. Hence the well-known efficacy, preventive and curative, of potatoes and of lemon or lime juice. This dietetic treatment may be aided, medicinally, by the mineral acids and barks; and, as a topical application, a lotion of dilute nitro-muriatic acid has an astringent and cleansing effect on the ulcer.

(9.) **Scrofulous or Strumous Ulcer.**—Consequent on the ulceration of a scrofulous tubercular swelling, or the opening of a scrofulous abscess, the ulcer is remarkably *indolent*, yet its characters are unlike those of the ordinary indolent ulcer. *Large, pale, flabby granulations*, sometimes *exuberant*, form the surface of the sore, with a *thin puriform discharge*; the *margin* is thin, livid, and undermined, sometimes pretending to heal by incrustation of the discharge. The characters and tendency are those of an ordinary œdematous ulcer; but a scrofulous ulcer is even less disposed to heal *soundly*. A scrofulous *cicatrix* appears drawn, puckered, and incomplete. The co-existence of indolent glandular swellings and abscess, in other parts, will complete the diagnosis.

Scrofulous ulcers are most frequent in the *neck*, groin, cheek, scalp; and about the knee, ankle, wrist, and elbow. They are often numerous and clustered.

Causes.—Whatever impairs the nutritive qualities of the blood and its circulation, predisposes to scrofula. Hence deficient or defective food, insufficient ventilation, want of cleanliness and excretion, poor clothing, cold, damp, and even dark localities, with other hygienic conditions of similar import, are the nurseries and nurses of this blood-disease. Individual *predisposition*, as usual, plays its part; for among a family of children in precisely the same hygienic circumstances, one becomes scrofulous, while the rest remain free.

TREATMENT.—In addition to the removal of any adverse hygienic condition, *iron, bark, and cod-liver oil* are calculated to strengthen the circulation and improve nutrition. The digestive organs will also require watchful attention. A *stimulating* plan of local treatment with moderate pressure on the ulcer is appropriate, as for an œdematous ulcer. Thus, nitrate of silver or sulphate of copper, and bandaging, are beneficial as topical appliances; but the more important part of the treatment is constitutional.

The *scar* of a strumous ulcer is unsightly, and may occasion deformity, either by contraction, or, more commonly, by over-growth, and the formation of bars raised in radiating lines, or networks, or tongues of skin. Excision of the scar may be necessary; but in many instances a great portion of the excess of scar can be removed by repeated slight blistering, and with time nearly the whole will level down.

Variety.—In a superficial scrofulous ulcer on the *hands* or *feet*,

sive growth of the *papillæ* at the base or borders of the ulcer, gives markedly warty character to the ulcer; which often remaining after cicatrization, leaves a coarse, nodular patch of skin, with opaque, thick scale. In this particular resembling a papillary epithelial cancer, the basis of this form of scrofulous ulcer may be determined, by the absence of hardness in the granulations or the base, of a sinuous or up-lifted border, and of rapidity of progress; and by the presence of more than one, perhaps many such ulcers.

These warty strumous affections may be cured by repeated applications of line-paint.

10.) **Cancerous Ulcer.**—Already described in this work, as part of the general history of cancer, the characters of a cancerous ulcer are here added to as compared with those of a lupoid ulcer. The scirrhus ulcer is most distinctive. Beginning in the skin and extending down to deeper tissues, or commencing subcutaneously—in a cancerous mass, and extending upwards to and involving the skin—the ulcer, formed in either, presents an *irregular cavity*, the surface of which is covered with *hard granulations*, discharging a thin, peculiar-smelling ichor; the edges are *elevated, thick, and everted*, with *circumferential induration*, and *mobility*. The neighbouring *lymphatic glands* become indurated, and enlarged. The ravages of this ulcer are unlimited.

TREATMENT.—Cauterization, or excision. See *Cancer*.

11.) **Lupoid Ulcer.**—Commencing as a fissure or soft wart, the ulcerated is an *excavated hollow*, having, commonly, *no granulations*, the edges *sharp, and overhanging*, with *no induration* around. The *lymphatic glands* are *unaffected*. But this ulcer, also, spreads and *sparcs no texture*. The disease commences in the earlier half of life, sometimes in childhood, rarely after middle age; and females are rather more liable to it than males. It is allied to scrofula.

TREATMENT.—Cauterization, or excision; with treatment as for scrofula.

12.) **Rodent Ulcer.**—Variously named, as Rodent Cancer, Cancroid, or Lupus Exedens, the nature of this ulcer is disputed.

Commencing as a troublesome *pimple*, situated generally near the inner or inner angle of the eye, this may disappear and return, during a period of some months or years; at length, a small, *superficial ulcer* is formed, having a *raised and hardened margin, set in healthy tissue*. Progressing *slowly*, as a fretting ulceration, it spreads to the nose or eyelid, paring the eye until a later period; extending in depth, the ulceration involves the nose and bones of the face, passing backwards even to the cranium, and thus forming a *hideous chasm*, overspread with a greyish necrotic matter. Rodent ulcer rarely appears under forty years of age; both sexes are about equally liable.

No kind of treatment has any curative efficacy. At an early period, the ulcer may be excised; or canterization, with fuming nitric acid, may have a beneficial influence in temporarily arresting the spread of ulceration.

13.) **Syphilitic Ulcer.**—Primary, secondary, and tertiary syphilitic ulcers form part of the general pathology of Syphilis.

Mortification.—The transition of ulceration to mortification, as has been noticed, will have suggested their mutual relation. As processes, they differ in degree, but are one in kind. The former may be exaggerated

into the latter, and this again may subside into that. Ulceration and mortification are convertible by gradations of the same process, disintegration of structure; the one, *molecular*, as a liquid discharge; the other *en masse*, presenting accumulations of disintegrated matter—a mortified part; e.g. the leg.

Signs.—*Gangrene*, or the incipient stage of mortification, exhibits certain characteristic appearances. The skin is *livid* or has a *black* hue, shading off to a reddish brown around the dying part. Its consistence is changed; becoming *soft*, with considerable *swelling* and pitting on pressure, while the cuticle is raised into vesicles containing a yellowish serum, or *phlyctenæ*—large blebs or bladders, full of bloody serum. The part is, in fact, altogether sodden and succulent, from the infiltration of the constituent cellular texture with serum. This is *humid* or *acute* gangrene. Or the part may be *hard*, *shrunk*, and *dry*; an opposite condition, known as *dry* or *chronic* gangrene. In either state, the *sensibility* of the part is diminished, and its *temperature* reduced.

The *odour* of gangrene is peculiar and pungent; it becomes fetid with the evolution of gas by decomposition, which, inflating the cellular texture, much increases the swelling; and owing to the admixture of gas and serum, it then has the additional character of *crackling* under gentle pressure, or of fluctuation like a collection of pus, if the deeper textures be thus distended. The part is irrecoverably dead; mortification having advanced to its second and furthest stage—the condition of *sphacelus*. The textures, in this condition also, may be dry and shrunk; as in senile gangrene which has advanced to sphacelus. In either case the part is insensible and cold, and does not bleed when cut, owing to coagulation of the blood within the vessels.

CAUSES.—*External and Internal; and their Operation.*—The pathology of ulceration and mortification being essentially the same, their etiology also is the same.

EXTERNAL causes are of three kinds: physical—as mechanical violence and injury, heat, cold, electricity; chemical decomposing agents; and vital, as animal poisons introduced into any living texture. Either of these external causes may *immediately* kill the part, or kill, if the tissue be vascular, by *inflammation* supervening and terminating, perhaps speedily, in ulceration or in mortification.

(1.) Violence or injury of any kind may give rise to gangrene, which is thence denominated *traumatic*. It is thus distinguished from gangrene arising from any internal, and commonly constitutional disease—e.g. a blood-condition; and which, as a local manifestation of that disease, is thence named *idiopathic* gangrene.

Of traumatic causes, *pressure* or *contusion*, *directly* applied, severely although momentarily, as by a squeeze, kills the part immediately. A finger caught in the hinge of a door may thus be squeezed to death. Pressure, continued, although less severe, excites gangrenous inflammation. In either case, mortification is limited to the part injured. *Indirect* contusion or concussion, as by a fall, causes either gangrene or gangrenous inflammation; and the mortification will be more extensive, although *ill co-extensive* only with the part injured. But the damage done to the *smaller* blood-vessels by concussion, may be far more extensive than could be anticipated.

or concussion—applied directly or indirectly—chiefly injures the vessels and smaller arteries; but traumatic gangrene more arises from injury to *larger-sized* blood-vessels. Considerable takes place, causing gangrene, partly by pressure of the mass among the textures, partly or principally by cessation of blood requisite for nutrition. Wounds implicating the blood-vessels, compound fracture, and dislocation, especially operate. Gangrene is *not* necessarily *limited* to the immediate seat of injury; it may extend—*e.g.* up a whole limb, but still has as the cause in operation.

Cold, and electricity require no further consideration as *causes* of gangrene, than that they operate, either by *killing* outright, or by *gangrenous inflammation*; cold, however, not seeming to have effect of killing a part at once. A frost-bitten or frozen portion of the body is not irrecoverably dead.

Chemical decomposing agents, on the other hand, mostly take effect *indirectly*—decomposing the living tissues with which they are in contact. Such are caustic alkalies, the concentrated acids, and other escharotics.

Animal poisons introduced into the body, are generally less immediately *lethal* to the part—*i.e.* they induce *gangrenous inflammation*. Venomous serpents represent this class.

Natural causes are perversions of the constituent elements of nutrition of a certain *quality*, suitable to each part for its nourishment; a certain *quantity* of this blood supplied to and circulated in each part; an appropriate *physical* and *structural* condition of the part itself; and some kind of *nervous influence*—these are the conditions which, when perverted, become internal causes of gangrene.

Blood-conditions, by alterations of *quality*, are eminently *causes* of gangrene. Thus are produced the phagedænic and sloughing diseases of syphilis. Other diseases of, or involving, the blood evince a tendency to gangrene; as manifested in uræmia, and diabetes mellitus. Gangrenous inflammation arising from any blood-disease spreads without limitation of its extent.

The *quantity* of blood supplied to and circulated through any part depends upon, and is regulated by, the heart's mechanism and action, the state of this organ; and the state of the blood-vascular system—veins, and capillaries.

Weakness, with weakness of the heart's action, is a rare cause of gangrene.

Both feet, as the parts most distant in the circulation, are most liable to be affected. This anæmic gangrene occurs sometimes in chlorotic females; the premonitory symptoms being fatigue, weakness, and rigidity of the hands and the feet.

Arteries are liable to undergo changes of structure, which are worthy of notice surgically.

Arterial or calcareous degeneration of the larger arteries, with thickening of the smaller ones, is accompanied with a more or less contracted state of the vessels, thus leading to coagulation of the blood in tubes which have become too narrow and rigid for the free passage of that fluid, and in quantity adequate to meet varying

demands. This condition represents the changes of structure concerned in producing "senile" gangrene,—a dry form of mortification, commonly affecting the foot, when the arteries of the leg have undergone these changes.

Arteritis—inflammation of an artery—is a far less frequent cause; it acts in a similar manner, and may induce gangrene of the same character, or more dry and horny.

Fibrinous coagulum may form as a thrombus within an artery, either by the deposition of fibrin around a calcareous projection from the interior, or in a sacculated dilatation of the vessel; in either way the clot, gathering more fibrin, advances into the artery, so as at length to entirely plug up the canal. Or, instead of arterial thrombosis, the coagulum may not have formed in the artery where it is found impacted, but have been washed from the left ventricle of the heart and carried thence by the current of blood to that vessel; such a clot being known as an *embolus*, and an artery thus impacted with clot, as *embolism*. The gangrene arising from either of these modes of arterial occlusion may be dry or moist, according to the rapidity and completeness of clot-formation or impaction.

Rupture of the internal and middle coats of a large artery, by violence, will also induce coagulation; the loose portion folding inward across the stream of blood. Mortification is liable to supervene.

Aneurism is another cause; partly by interrupting the free flow of arterial blood through the aneurismal artery, and partly, by pressure on adjacent veins, obstructing the return of venous blood. Popliteal aneurism will thus induce gangrene, which soon passes into sphacelus.

Pressure on a main artery may also induce gangrene in the part supplied—distal in the course of the circulation. A tumour may act in this way; or the surgical application of a *ligature* have the same effect; compression of the artery impeding, or cutting off, the supply of arterial blood.

Injury of a main artery acts in two ways. A punctured wound is sometimes an immediate cause, by loss of blood; gangrene taking place in the extremity. Contusion of the vessel may be followed by sloughing, hæmorrhage, and gangrene of the limb. In either case, the integuments may have escaped injury. Simple fracture, and perhaps simple dislocation, will thus lead to mortification, occasionally; compound fracture and dislocation, far more frequently.

In any case of interrupted or arrested supply of blood through a main artery, the sudden even more than the persistent operation of such cause, will tend to induce gangrene; by not allowing time for the substitution of a *collateral circulation*.

It is highly important to observe the partial extent to which gangrene spreads, in connection with all these vascular lesions, as contrasted with gangrene arising from any constitutional cause. Unlimited in that case, it is here *limited in extent* to the *source* of gangrene, and probably restricted to less than that extent, by the enlargement of branches coming from the artery above the seat of injury, which supply a collateral and compensatory circulation of blood.

(b.) *Veins* are less liable to become causes of mortification; obstructed to the return of venous blood from any part of the body, having a

ant relation in this respect, than obstruction to the supply of blood. Gangrene arising from venous obstruction is always the moist condition; more or less fluid being retained, and infiltrating the part.

It induces coagulation of blood within the vein or veins in which this obstruction is attended with œdematous swelling of the part below. The swelling becomes tense and persistent, a concurring cause on gangrene. *Phlegmasia dolens*, in which the iliac and femoral veins, the main venous trunks of the limb, are inflamed, thus inducing the above.

Obliteration of a venous trunk is another such cause, once in a case of anasarca.

Vein-stones, not unfrequently formed within various veins, particularly the iliac, have a similar tendency to produce obstruction. When venous obstruction has been *gradually* established, adequate compensation is provided, by the contemporaneous opening of other veins, through which the blood flows without impediment.

Mal varix and *varicose aneurism*, resulting from a communication between an artery and a companion vein, as from unskilful venesection at the bend of the elbow, is attended with venous engorgement, and increasing, and œdematous swelling of the limb below, inducing gangrene.

External pressure on a large vein, itself in a healthy state, is an cause of obstruction to the return of venous blood. Tumours, indirectly, have this effect in relation to mortification. But, *direct pressure* produces an entire arrest of the circulation, arterial and venous, by the application of a tight bandage at the elbow, after causing gangrene of the hand; the constriction of paraphimosis induces gangrenous inflammation of the prepuce; and a hernial sac induces gangrene of the included bowel or omentum. On any part of the body, the influence of prolonged pressure is witnessed in the formation of ulcers, as bed-sores.

Situation of gangrene is no less characteristic of that which arises from obstruction in the course of a large vein, than from obstruction in the course of a large artery; the gangrene, in either case, extending possibly to a considerable distance within, that situation.

Classes of causes, those pertaining to the arteries and those to the veins, concur; and differ from any constitutional cause, inducing gangrene.

Limitation dependent on *some* venous causes, like that dependent on *some* arterial causes, can scarcely be *foreseen*. *Diseased* constricted vessels are more often perplexing in this respect, as compared with the agency to gangrene of *traumatic* origin.

Illaries.—*Compression* of these vessels is followed by gangrene of the part, if thereby deprived of a due supply of blood.

Distention, therefore, with lymph-production, and compression of the vessels, reacts destructively upon the textures. Moreover, the products, for the most part, are inherently short-lived.

Physical and structural conditions of the part relative to mortification.

Of physical properties: an *unyielding fascia* or aponeurosis, *e.g.* the *fascia lata*, predisposes subjacent textures to gangrene, by pressure in the event of any effusion of blood or serum therein. *Looseness* of texture also predisposes to this issue, by favouring an interstitial accumulation of blood or serum.

Structural conditions predispose to mortification; the proportion of blood vessels having this relation. Both extremes meet. Thus, comparatively *avascular* textures have a tendency to gangrene; *e.g.* the liability of cellular texture to slough, from any cause. Highly *vascular* textures also have a similar tendency, apparently by favouring the intensity of inflammation and effusion; *e.g.* the skin as compared with fibrous or tendinous textures, which often resist sloughing long after the integument has disappeared in consequence of an extensive burn.

(4) *Nervous influence*, of some kind, plays an important part in mortification and ulceration. For example, injury to the spine has been followed within twenty-four hours by mortification of the ankle; and the tendency to necrosis in such a case, or of the cornea in connection with neural paralysis, is equally remarkable.

The *force of Mortification* has been noticed in connection with inflammation proceeding to Gangrene.

TREATMENT OF MORTIFICATION.

Practically, a comparatively brief survey of the pathology and etiology of mortification, and the treatment, may be indicated. The treatment is fourfold:—
1. To remove the cause of the disease, if possible, and thus arrest the progress of the disease.

2. To remove the dead tissue, and thus prevent the formation of a sequestrum, a limb; and to prevent the formation of a sequestrum.

3. To remove the dead tissue, and thus prevent the formation of a sequestrum, a limb; and to prevent the formation of a sequestrum.

4. To remove the dead tissue, and thus prevent the formation of a sequestrum, a limb; and to prevent the formation of a sequestrum.

5. To remove the dead tissue, and thus prevent the formation of a sequestrum, a limb; and to prevent the formation of a sequestrum.

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11. To remove the dead tissue, and thus prevent the formation of a sequestrum, a limb; and to prevent the formation of a sequestrum.

12. To remove the dead tissue, and thus prevent the formation of a sequestrum, a limb; and to prevent the formation of a sequestrum.

13. To remove the dead tissue, and thus prevent the formation of a sequestrum, a limb; and to prevent the formation of a sequestrum.

14. To remove the dead tissue, and thus prevent the formation of a sequestrum, a limb; and to prevent the formation of a sequestrum.

ence to the *spreading* of gangrene, and the probability of its *recurrence* in the stump.

The consideration which *partly* determines this question is, the *Constitutional* or the *Local* origin of the gangrene.

In the former case, spreading *without limitation* as to its extent, amputation must be postponed *until* the "line of demarcation" has formed; in the latter, limited in its extent to the *source* of gangrene, and probably restricted to within that boundary, by the establishment of a collateral circulation, from above to below, amputation may be performed *prior* to the formation of the line of demarcation. Thus, in traumatic gangrene from whatever cause,—contused or lacerated wound, compound fracture or dislocation—amputation is determined, not by waiting for the limitation of sloughing, but by the extent of injury as its source.

But in *certain* of these naturally *limited gangrenes*, the limitation *cannot* be *foretold*, simply because the exact situation of the causative condition cannot be diagnosed. Of *arterial* conditions; such are ossification of a main artery or arteries, leading to senile gangrene; arteritis, indefinite in a lesser degree, as to its extent; embolism; and partial rupture of an artery without any external wound. Of *venous* conditions; such also are fibrous obliteration of a large vein; phleboliths or vein-stones impacted; and phlebitis, indefinite as to its extent.

Hence, in all these cases, arterial and venous—the treatment appropriate for the particular causative condition having failed—amputation must be deferred *until such time* as nature has indicated, by the formation of the line of demarcation, that limitation which cannot be foreseen. The venous conditions referred to seldom, if ever, necessitate amputation.

On the other hand, the line of demarcation *can* be *foretold*, in other cases of *definitely* local origin. Such are aneurisms, spontaneous and traumatic, and wounds of a main artery; aneurismal varix, and varicose aneurism; and any occasion of prolonged pressure, or ligature, on a large artery or vein. Hence in all *these* cases—arterial or venous—the treatment appropriate for the particular causative condition having failed, amputation may be resorted to before the formation of the line of demarcation has indicated the actual extent to which the gangrene will spread.

Generally speaking, the rule for amputation may be thus stated, in all cases of Local origin; *idiopathic* gangrene, however caused, suggests the postponement of amputation *until* the limitation of gangrene is declared by Nature; whereas *traumatic* gangrene, however caused, suggests amputation more immediately, this anticipation of Nature by Surgical Art then being justifiable.

In *Spreading* traumatic gangrene, the question of amputation is to be determined rather by the consideration that a *Constitutional* cause is in operation. Operative interference, therefore, should be deferred, pending the formation of the natural line of demarcation. The contrary rule is, however, maintained by some Surgeons of large experience; that in this condition, if life be in danger, amputation should be performed, although gangrene may yet be spreading.

(3.) Solicitation of the natural separation of the dead part, with reparative closure of the blood-vessels; and the healing process of granulation and cicatrization.

Constitutional gangrene, or gangrene arising from *Local* conditions

the exact situation of which cannot be diagnosed, may, in either case, have compelled the delay of amputation until the line of demarcation takes place; but Surgical Art should solicit this limitation, and thus also, if possible, restrict the extent to which the gangrene might otherwise have spread. By maintaining the *temperature* of the part not yet mortified, the local circulation may become diffused sufficiently to sustain its vitality; whereby the line of demarcation between the living and the dead portions will be declared. Hence the preventive value of cotton wadding, with which material the limb should be deeply enveloped. This padding need not be reapplied for some days; the gangrenous part being covered with lint soaked in a solution of permanganate of potash (Condy's fluid), a chlorinated, carbolic, or other antiseptic lotion. Concentrated solutions of carbolic acid, e.g. 3ii. to 1 lb. of olive oil, are apt to induce symptoms of poisoning, indicated by olive-green urine. A poultice of powdered charcoal answers the double purpose of an antiseptic and moist warm dressing.

(4.) *Constitutional Treatment.*—Prior to closure of the vessels, the constitutional disorder consequent on gangrene—the typhoidal fever—requires supporting measures; an easily assimilated diet, comprising proportionately more animal food, malt liquor, and alcoholic stimulants, will prove most beneficial. Opium is, generally, a remedy of great value, apparently by subduing the pain and nervous excitement; and by promoting capillary circulation, thus aiding the process of separation. It should be administered in small but repeated doses, to the amount of two to four grains in the twenty-four hours, and increased as the system is brought under its influence; but opium is contra-indicated or must be discontinued, whenever it disturbs the digestive organs or occasions headache. The hypodermic injection of morphia may, however, not be odorous.

Inflammatory fever, in some degree, accompanies occlusion of the vessels during the separation of the gangrenous part; opium may, therefore, still be continued to suppress nervous excitement and the heart's action, while it perhaps sustains adhesive inflammation. The stimulant and tonic plan of treatment should be moderated during this period, and resumed during convalescence.

White Gangrene.—The association of a livid or black discolouration with gangrene is so invariable, that to speak of gangrene as distinguished by the white appearance of the part thus affected, seems anomalous. And, indeed, this is a very rare affection; apparently of neurotic origin. It is noticed more fully in the Author's "Surgery."

DISEASES OF THE BLOOD.

CHAPTER IV.

SCROFULA.

By the term *Blood-disease*, I mean a disease in which some alteration of the blood is the primary affection, as from a poisoned wound; or is the central condition, although the blood-forming organs, and all the textures, in the processes of assimilation, primary and secondary, and thus the whole body, may be engaged in the disease. The latter will be considered first, as representing blood-diseases of a *constitutional* character, essentially.

General Symptoms.—Scrofula exhibits itself locally by “malnutrition and chronic inflammation.” This inflammation is scarcely expressed by pain or heat, or redness, but rather by swelling, more or less considerable and doughy, slowly enlarging, and tending to suppuration; yet scrofulous suppuration is unwilling, so to speak, and the pus a mixture of curd and serum. Should a scrofulous abscess point, the skin thins, but gradually, and assumes a purplish tint; an irregular rent follows after some time, and the flaky matter rolls out. Perhaps this aperture gets blocked up and imperfectly closed; the matter reaccumulating, again to be discharged, and so on from time to time. Or the aperture may remain free, with puffy everted edges, of a purplish colour, and the discharge continue—now thick, now thin.

The *scrofulous ulcer*, which eventually results, is equally indolent.

Special Forms.—Scrofula is essentially a *pervading* disease. It blossoms and bears fruit chiefly in the lymphatic glands, in the skin and cellular texture, mucous membranes, bones and joints, eyes, salivary glands, tonsils, ears, breasts, and in the testicles. Then, again, various parts are rarely affected simultaneously, but consecutively; the scrofulous affection *migrating* from one texture or part to another texture or part. In most textures, the disease evinces a marked tendency to *spread*, as in scrofulo-derma and caries.

(1.) **LYMPHATIC GLANDS**, so called, appear to solicit the deposit of *scrofulous matter*. At first soft and fleshy, these glands enlarge and harden; portions of each gland are observed to have altogether lost their *flesh* colour, and acquired a degree of transparency, and a texture approaching to that of cartilage. At length, a soft, white, or yellowish, curd-like substance is deposited. Glandular tumours, thus formed about the neck and groin, sometimes attain an enormous size; in the latter situation,

being perhaps half as large as the head of a new-born child. Scrofulous glands are remarkably indolent, but eventually they soften and discharge the peculiar pus—flaky and ichorous, perhaps cretaceous matter; or they remain as soft and spongy tumours, beneath a thin, silky cuticle, which frequently breaks and oozes; or they waste, and are at length represented only by a few bands of condensed cellular tissue attached to the cicatrized integument.

(2.) The CELLULAR TEXTURE is peculiarly liable to exhibit scrofulous swellings, bordering on suppuration or actual collections of matter.

In the subcutaneous cellular tissue, scrofulous *gummata* or small nodules are apt to form, closely resembling scrofulous glands in appearance. They often appear very suddenly; and from the absence of pain and discolouration, they may exist a long time without being perceived.

In the *sheaths of muscles*, large chronic abscesses sometimes gather insidiously, containing the pus which characterizes scrofulous suppuration.

(3.) The SKIN is more than liable—it is prone—to scrofulous eruptions and ulceration. According to the special experience of Sir Erasmus Wilson, cutaneous scrofula is presented in two conditions—that of *tubercles*, and that of *ulcers*. Scrofulous tubercles are small, purplish or livid, indolent tumours. They soften internally and discharge an imperfect pus, remain open or fistulous for a long time, and on disappearing, frequently leave hard knots in the skin. They appear on the neck and face, and near ulcers resulting from inflammation of the lymphatic glands. When such tubercles have partially discharged their contents, a crust of inspissated matter forms, which being rubbed off occasionally, exhibits an open sore, with an ichorous discharge, and no disposition to heal. Eventually an ugly cicatrix or scar marks the site of these sores.

Inflammation of the *matrix* of one or other of the *nails* is not uncommon, more particularly in young persons having the scrofulous diathesis. Scrofulo-derma ungueale, so named, begins by inflammation of the skin immediately round the edges of the nail about to be affected; then follows considerable swelling, with vivid redness of the end of the finger, extending even to the bone, and presenting the appearance of a clubbed finger. The nail is shed, disclosing an angry raw surface, upon which, from time to time, there reappears a rugged, ill-formed, and imperfect nail. Fungous granulations and unhealthy pus continue for perhaps many months.

Other *Cutaneous* manifestations of Scrofula are known as Diseases of the Skin, occurring in scrofulous persons.

(4.) The OSSEOUS SYSTEM and the JOINTS seem to invite scrofulous inflammation. In the *extremities* of long bones, or in the bones of the carpus and tarsus, their cancellated portion is specially liable to undergo scrofulous caries. Sometimes this species of malnutrition runs its course within the *shaft* of a long bone.

(5.) In the career of scrofula, MUCOUS MEMBRANES are not exempt from harm, particularly if its blood-associate, tuberculosis, be considered an ally. The eyes, ears, nose, upper lip, tongue, tonsils, salivary glands, larynx, and *trachea* are mucous membrane, severally exhibit scrofulous inflammation; yet together limited to the mucous membrane in connection

thalmia is a variety of conjunctivitis, characterized by

great intolerance of light; so that the child (for this affection occurs mostly in young subjects) seeks a dark room, or buries its head in the bed-clothes, and screws its brows together with screaming agony on any attempt being made to examine the eyeball. When the eyelids are separated, a copious flow of tears trickles down the cheeks, excoriating the face. The eyeball is now involuntarily upturned to avoid the light, a patchy redness is observable on the conjunctiva, and vesicles or pustules are seen here and there at the margin or on the surface of the cornea. These pustules burst and expose small ulcers. Frequently an interstitial deposit overshadows the whole cornea, which thus becomes thickened and opaque, projecting also, so that the eyelids cannot be closed. This is one destructive sequel, and should ulceration of the cornea not terminate comparatively favourably, in specks of opacity, perforation of the anterior chamber will be inevitable, the aqueous humour is discharged with prolapse of the iris, and the eye collapses.

Fretting ulceration of the Meibomian glands, attacking the margin more especially of the eyelids, and known as *ophthalmia tarsi*, is a frequent concomitant of scrofulous ophthalmia; or this diseased condition extends to the iris, giving rise to *scrofulous* iritis.

The organs of hearing do not escape. *Otorrhœa*, the purulent discharge being fetid and abundant, is a very common affection; or, chronic suppuration perforates the tympanum; the ossicula crumble, loosen, and are washed out by the discharge.

The nose assuredly enjoys no immunity. Habitual swelling, ulceration, and fetid discharge from the pituitary membrane—*ozæna*—may or may not be accompanied with caries and discharge of portions of the spongy bones.

The upper lip is commonly tumid, protuberant, and chapped. Fissures also and ulcerated spots are seen on the tongue. Nodules, moreover, superficially imbedded in the substance of this organ are said to arise in most instances, and to present the following characters. They vary in size from a small shot to that of a horse-bean; are painless, unless subjected to firm pressure, which occasions a pricking sensation. The superimposed mucous membrane reddens, soon breaks in the centre, and forms an ulcer, which spreads and destroys by sloughing erosion; accompanied with much pain, profuse salivation, furred tongue, and fetid breath. If cicatrization ensue, hardness still remains; fresh nodules also form in other parts of the tongue. The gums may present a red line, sharply defined, along the edge, opposite the incisor and canine teeth. (Ruehle.)

Chronic and considerable enlargement of the tonsils, with perhaps indolent ulceration, is another outbreak of the scrofulous diathesis; so likewise is swelling of the sub-lingual, sub-maxillary, and occasionally the parotid salivary glands; but these affections alike owe their significance to the invariable co-existence of other local diseases of more unequivocally scrofulous origin.

Chronic laryngitis may be due to this constitutional cause. The vocal cords become thickened; the voice therefore is hoarse or squeaking, and the breathing embarrassed; a tickling cough from time to time ejects a slimy, not frothy, expectoration, streaked with blood perhaps; or the spata are muco-purulent. In either case the breathing is relieved by this expectoration; but eventually ulceration of the rima glottidis renders its

closure imperfect, the act of coughing incomplete, and expectoration therefore difficult; so that the respiration is yet more oppressed. Should ulceration of the epiglottis supervene, there will be considerable difficulty of deglutition.

In the *genital mucous membrane*, scrofula is manifested by profuse *chronic urethral discharge*; or, by the *leucorrhœa* and *catarrhal vulvitis*, which occur in female children. *Tubercular cystitis* is also met with, as a rare affection.

(6.) A certain **MAMMARY TUMOUR** was first described by Sir A. Cooper; *painless*, distinctly circumscribed, very smooth on its surface, and scarcely tender to pressure. It is very *indolent*. Distinguished from simple chronic inflammation of the breast, by the absence of tenderness, and by the existence of other diseases of a similar kind in the lymphatic glands of other parts of the body.

(7.) Lastly, a peculiar **ENLARGEMENT of the TESTICLE**, or rather, of the **EPIDIDYMIS**. (See **SCROFULOUS SARCOCOELE**.)

Causes.—(1.) *Temperament*.—No one temperament alone possesses the scrofulous character. It is the tendency of those whose circulation is habitually weak—are *leucophlegmatic*—who have flabby muscles, a dull ruddy complexion, large heads, pigeon breasts, tumid bellies, and large joints; but then the strumous tendency is manifested in those persons also who, with a more active circulation, are rather of the *sanguine* temperament, have firmer muscles, a clear, transparent, ruddy complexion, which readily assumes a purple or livid hue by exposure to cold. The circulation, although active, is susceptible.

The same strumous tendency may be evinced in the highest degree by those who, without any marked character of circulation, are habitually subject to biliousness. In such persons the liver seems to be their weak point. Sluggish, yet enduring power is theirs also; and hair approaching black in colour, a dark olive or yellowish complexion, and dry skin, are aptly associated with a gloomy, often resolute, and reflective disposition. Theirs is the *melancholic* temperament. These are the chief signs of the scrofulous *diathesis*, although it may appear also in persons of the *nervous* temperament; and, indeed, the same tendency can be induced in those who are congenitally most indisposed to it when subjected to circumstances favourable to its development.

(2.) *Hygienic Conditions*.—Whatever impairs the nutritive qualities of the blood and its circulation may produce scrofula. What may be called, in a word, *alley-life*, is thus often the parent of this disease. *Individual predisposition* plays its part; for among a family of children in precisely the same hygienic circumstances, one becomes scrofulous, while the rest escape. Phthisis begets scrofula, and this disease transmits its own tendency, from parents, or either parent, to offspring. And the interchangeable nature of these diseases is shown in altered *hereditary* predisposition; phthisis in one generation appearing as scrofula in the next, succeeded by phthisis again in the third. Sometimes an intermediate generation is passed over, the individuals being free from either disease. Scrofula makes its appearance in early life; although sometimes not until old age, as "*senile scrofula*."

"*Exciting* causes sometimes evoke the constitutional disposition, by in the production of glandular affections. The irritation

of teething may thus give rise to enlargement of the cervical lymphatic glands; and a current of cold air often induces tonsillitis.

Treatment.—*Preventive* measures are far more efficacious than remedial treatment. Due attention to food is primarily important. Experience suggests a light nutritive diet, and not to overload the stomach by a heavy meal. Stimulants may be necessary to assist digestion, but they should be indulged in sparingly. The pampered scrofulous child of affluent parents is as badly off as the ill-fed child of the poorest. The bowels, which are very apt to be costive, or at least irregular in their action, will require the assistance of gentle aperients, such as rhubarb or the confection of senna. Not less important is daily exercise in pure air, and ablution not only to cleanse the skin, but to invigorate the circulation and promote excretion. Hence, sea-bathing may prove very beneficial. Friction with horse-hair gloves and belt, or a rough towel, and warm clothing, with flannel next the skin, are likewise salutary. But, a warm, dry, light locality for habitation, in a well-ventilated and well-drained dwelling, constitute the hygienic surroundings which are most preventive of scrofula.

Certain medicinal agents, principally iron, iodide of potassium, bark, and cod-liver oil, have an acknowledged therapeutic value.

Local treatment has some effect on the *chronic enlargement of glands*, and of other parts, arising from scrofulous deposit. Applications of the compound tincture of iodine, or the stronger *iodine-paint*, may be advantageously aided in their stimulant operation by the *pressure* of strapping with soap plaster, or bandaging. Usually, however, these glandular enlargements will not subside, at least under topical treatment. *Cautery-puncture* answers the purpose of destroying the gland-tissue, especially when in a state of caseous degeneration and discharge, it is beyond hope of recovery; or the effete material may be turned out by incision, and scooping with a Volkmann's spoon. But a mass of glands had better be *excised*. When *abscess* forms, and discharges subsequently as an *ulcer*, these results must be treated accordingly.

Operations for scrofulous conditions of the bones, joints, or other parts, are unfavourable. Constitutional treatment will often succeed in averting the necessity for excision or amputation; a highly important consideration, since any local form of a constitutional disease is always an unfavourable condition for operation, and the removal of the part affected can in no way cure that disease as the primary cause. Hence, also, the postponement of such operation may not unfrequently be justifiable; and until the local condition becomes more defined, or its progressive extension renders operative interference imperative, whether with regard to the part affected or its reactive influence on the general health.

Scurvy, and Purpura; Rheumatism, and Gout.—See Author's "SURGERY—SCIENCE and PRACTICE."

DISEASES OF CONTAGIOUS ORIGIN.

CHAPTER V.

By the general term Contagion is meant the communication of Disease, either by external contact with morbid matter, perhaps of an imperceptible kind, or through the inhalation of such matter in the atmosphere by the act of breathing-in, which is sometimes distinguished as Infection. The disease produced by the former mode of contact is not necessarily constitutional, but, possibly, merely a local affection; *e.g.*, Itch, as contrasted with secondary or constitutional Syphilis.

Certain Diseases of the Blood, which come within the province of Surgery, are naturally associated, as being Contagious, or the offspring of Contagion; Syphilis, Erysipelas, Pyæmia, Hospital Gangrene; Hydrophobia, Snake-bites, Malignant Pustule. Of these diseases, the first four are derived from the *human* species, the remaining three from *animal*. This distinction allows a corresponding division of the whole class.

SYPHILIS.

Syphilis is essentially a blood-disease, produced by the introduction of a specific virus or poison into the general circulation. Its introduction, by local contact or by inoculation, is attended with certain tolerably definite manifestations in the skin or mucous membrane of the part, and in the proximate lymphatic glands, in the form of chancre and bubo, respectively,—constituting *primary* or *local* syphilis; while the consequent blood-disease is manifested by certain tolerably definite inflammatory modifications of nutrition in the skin, mucous membranes, eyes, testicle, periosteum, bones, and other parts,—constituting *secondary* or *constitutional* syphilis. But the term *Syphilis* is also understood to signify an *entirely* constitutional disease; the term *Chancre* being restricted to the *primary lesion* or ulcer at the point of inoculation of the virus, which, followed by lymphatic absorption, in the form of bubo, gives rise to systemic infection or Syphilis. The so-called *Chancroid*, or *Local Contagious Ulcer*, would thus be distinguished from the absence of systemic infection. Gonorrhœa has long been an entirely distinct disease, arising from the contagion of virus, which produces an inflammatory discharge from the mucous membrane, of a contagious character, but which does not enter the system. These three diseases, Syphilis, Local Contagious

Ulcer, and Gonorrhœa, alike arising from impure sexual intercourse, are included under the common term—*Venereal Disease*.

Primary and Local Venereal Ulcers.—(1.) **CHANCERE**, and its **DIAGNOSIS.**—Chancre is a primary *syphilitic* sore or ulcer. After exposure to contagion or inoculation, a period of *incubation* ensues, during which nothing is discernible, and the individual thinks himself well. The *duration* of this period varies, averaging from *two to three weeks*, and being rarely under a week (H. Lee), but, perhaps, extending to five or six, and very rarely to eleven weeks. (Bumstead.) Then the primary manifestation of syphilis begins. Commencing with a trifling *itching*, affecting usually some spot in the furrow at the base of the glans penis, near the *frænum*, or it may be on the prepuce or the skin of the penis itself; there soon appears, as the initial lesion, a small *pimple*, whose summit speedily becomes a *vesicle*, containing a thin transparent fluid-lymph, or becoming thicker and opaque—in fact, purulent—when subject to irritation. The vesicular stage of chancre is seldom met with. This vesicle or pustule bursts and forms an *ulcer*. If the syphilitic virus be introduced through a *crack* or *abrasion*, which may happen in the act of intercourse or have existed previously, the chancre forms an ulcer, without any incipient pimple or vesicle; obviously because the cuticle there raised by secretion, was here removed.

The primary syphilitic *ulcer* may appear in either of two forms. (a) A *superficial erosion*, flat or elevated, when the subjacent induration has taken place. The shape of this sore is *circular*, but sometimes irregular; and it has a smooth or polished surface, of a red or greyish colour, over-spread with a discharge consisting of lymph-globules and epithelium scales. Or, (b) the ulcer presents a small circular *cup-shaped cavity*, having a smooth, red interior, without granulation, and discharging a thin serous fluid, or glazed with a little adhesive lymph, and set in apparently healthy texture. About the *end of the first week*, and never before the third day, chancre becomes *indurated*, and circumscribed, like a split pea, by an effusion of plastic lymph beneath its base, and around the ulcer; its colour now having a fawn hue, or assuming various shades of brown or red, according to the secretion. A single exception is met with in chancre on the glans penis, which rarely acquires induration. It is here simply a spot denuded of cuticle, and having a red, moist, glistening, flat surface. (c) Occasionally, no ulcer is produced, nor perhaps any discoverable breach of surface; but induration appears in the form of a hard *knot* or *tubercle*, imbedded, and covered with epithelial scales.

The *duration* of chancre, as an open ulcer, is commonly a period of *some weeks*; it continues often until after the appearance of secondary symptoms, and being thus *indolent* and indisposed to heal, it then *cicatrizes* slowly and perhaps imperfectly; or the sore may reappear. *Induration* remains for a longer period, usually for at least *two or three months*; especially when the chancre is situated in the furrow at the base of the glans penis.

The *termination* of chancre is not attended with any loss of substance, and thus there is *no marked cicatrix*. When situated on the skin, as the outer aspect of the prepuce, a brown or dusky-red discolouration often remains, which, however, at length fades away into a white colour.

Chancre is generally *solitary*; although sometimes more than one

such sore may be produced. It is *protective* against the recurrence of a similar sore, conferring a relative, but not an absolute, immunity against subsequent attacks. Thus, inoculation with the secretion of chancre fails to reproduce chancre in the same person, or in another person already affected; in other words, chancre is neither capable of *auto-inoculation*, nor of *hetero-inoculation*; the reason of non-reproduction being, apparently, that the system or constitution is already under the influence of the syphilitic virus—syphilis is established. Whenever the discharge from an indurated chancre proves to be inoculable, it never begets a similar sore, but only a pustule, and then some slight erosion or ulceration. The failure of reproduction may, therefore, be regarded as *diagnostic* evidence that the ulcer is a chancre.

But it should be observed that *no one character* of chancre is invariably constant, nor peculiar to this species of ulcer, and, therefore, not absolutely pathognomonic; neither its period of incubation, its circular shape, its induration, its indolence, nor its protective power, and non-inoculable nature. Taken collectively, however, and in *conjunction* with an indurated or a bullety-hardened enlargement of the neighbouring lymphatic glands, forming a *multiple indurated bubo*, the ulcer is then recognized as a chancre. The co-existence of secondary symptoms in constitutional syphilis, will of course strengthen the diagnosis.

(2.) CHANCROID, OR THE LOCAL CONTAGIOUS ULCER.—Commencing as a *pustule*, which bursts, or occasionally as an open sore, the *ulcer* formed has a *circular* shape, as if punched out; but the *base* presents a cellular or honey-combed, worm-eaten appearance, and is covered with a greyish-yellow membranous secretion, consisting of disintegrated texture and pus-globules; and the *margin* of the ulcer is a little undermined and vertical, instead of sloping inwards to the base, as in hard chancre. No induration ensues, so that when the prepuce, for example, is retracted, the ulcer bends upon itself, instead of rolling over *en masse*, like the indurated chancre; and on raising the sore between the thumb and finger, it feels quite *soft* and *doughy*, its edge and base moving easily, and a little pus oozes out; it is a *soft* and *suppurating* ulcer, the “soft chancre,” or the “simple, non-infecting chancre,” so named by Ricord. Attended with some loss of substance, the ulcer *heals by granulation*, generally in a *shorter period* than chancre, and cicatrization leaves a *depressed* and *permanent scar*.

This soft, suppurating sore has no period of incubation; it appears from *two to four*, rarely five *days*, or within a week, after exposure to contagion. Chancroid is much more common than chancre; perhaps in the proportion of 4 to 1, though some say 3, or only 2 to 1. It may be solitary, but is often *multiple*; and it affords *no protection* against recurrence, conferring no immunity whatever for the future. The ulcer is *reproductive* by inoculation, and the reproduced sore can be propagated in like manner. Hence, this fact supplies a *diagnostic* test of chancroid; or, as often happens accidentally, the purulent secretion affects contiguous parts. The ulcer is sometimes associated with a soft and suppurating enl-

neighbouring lymphatic gland, as in the groin—a *suppu-*

existence of chancre and chancroid—the indurated and
3 ulcer—or of either species with gonorrhœa, may be

ned. And the co-existence of the two species may occur in the same person—a suppurating ulcer, with an indurated base, an auto-inoculable chancre, and which is capable of communicating syphilis to an uninfected person. Such is the *mixed* chancre of Rollet. The consequent may be both indurated and suppurating.

A *double* chancre is produced by *double inoculation*, occurring perhaps at the same time; as in sexual intercourse, when a healthy man has contact with a woman having both a chancre and a chancroid; or the infection of either species may be *engrafted* upon a *pre-existing* ulcer of the opposite species. Chancroid may be contracted by an individual already infected with secondary or tertiary syphilis; and the ulcer then retains its original character, and runs its course.

The *apparent interchange* of the two kinds of ulcer is liable to happen, especially, from various accidental circumstances of irritation, inducing induration, or induration, as the case may be.

The *conversion* of indurated chancre into the soft chancroid ulcer, may seem to be an admitted possibility, as resulting from the *transmission* of the syphilitic virus through the system of a person who had previously undergone syphilitic infection.

Diseased Conditions of Chancre, and Chancroid Ulcer.—Either the specific ulcers may assume the characters of some ordinary form, or, under circumstances referable to the state of the general health, or to the state of the digestive organs in particular. Thus, the ulcer may be *irritable*, or painful and disposed to bleed; if *inflamed*, the usual appearances of this kind of ulcer are presented. *Phagedænic* chancre is an irregular sore, with sharp, undermined edges, and a worm-eaten surface, covered with a white or black slough; *serpiginous* phagedænia is a variety distinguished by the creeping character of the ulceration, limited extent and duration; and *sloughing* or *gangrenous* phagedænia has the mixed characters which its name implies. The three last varieties of ulceration are very destructive, especially the latter variety. When affecting the prepuce, this part becomes greatly swollen, brawny, dusky red; but the phimosis or contracted state of the preputial skin conceals the ravages beneath; a black patch appears, and sloughs, involving the glans, or if the foreskin be split up with a bistoury, the phagedænic ulcer is discovered, and perhaps only a remnant of glans.

Location.—The external parts of the *genital* organs are obviously the most liable to the situation of chancre, and some parts are more especially liable. In the *male*, that portion of the penis is commonly the seat of chancre, which having been exposed in sexual intercourse, is apt to retain contact with the clitoris with which it came in contact. Hence, the furrow between the scrotum and prepuce, and perhaps near the frænum, is the most frequent situation; but chancre may form on the inner surface, or at the margin of the prepuce, or on the frænum; sometimes on the glans, or at the base of the urethra, or perchance on the skin of the penis. *Urethral* chancre is, however, not unfrequently met with; the chancre being situated immediately within the orifice of the urethra, or higher up in the canal.

In the one case, it may easily be seen on just evertting the lips of the urethral aperture; in the other case, it can be felt as a more or less indurated induration of the urethra when pressed between the thumb and forefinger.

Urethral chancroid emitting its discharge from the external orifice,

may be mistaken for gonorrhœa; but, while their diagnosis cannot be determined by the variable appearance of the discharge, inoculation will evince its true nature; a chancroid being produced if the matter be syphilitic, and not by gonorrhœal discharge.

In the *female*, also, the external genitals are the common situation of chancre, as just within the labia minora; less frequently on the mucous membrane of the vagina, or on the os uteri, or within the cervix. In certain *unnatural* situations, chancre may occasionally be found; as at the anus, or on the lips of the mouth; suspicious of depravity which need not be named.

Bubo, and its Diagnosis.—Bubo is a generic term, signifying a swelling of the lymphatic glands, and specially those of the groin (*Beecher*, the groin), of an inflammatory character, acute or chronic, and with or without suppuration. It may arise from any cause of local irritation, affecting the lymphatic vessels continuous with the glands, producing sympathetic bubo; or proceed from the absorption of poisonous matter, or virus. Glandular enlargement may depend on constitutional causes, as scrofula; or it may be cancerous.

(1.) **SYPHILITIC OR INDURATED BUBO** denotes absorption of the syphilitic virus from the primary sore, which, on its way to the blood through the lymphatics, irritates the nearest lymphatic glands—commonly the inguinal—whereby they become swollen and hard, and perhaps suppurate.

On the other hand, it has been held that bubo may possibly arise from direct absorption, without the previous formation of chancre; that bubo may thus be the only primary symptom. Such buboes, therefore, have been named “primary buboes,” and by the French, “bubons d'emblée.”

Indurated bubo begins at a period of about eleven days (Rollet), and never later than *two weeks* (Ricord), after the commencement of chancre; or, usually, at a somewhat earlier date, the time when induration of the base of the chancre takes place. (Bumstead.) It appears as a *hard, bulky, and scarcely painful* swelling of the lymphatic gland, nearest to the spot whence the poison was absorbed; the lymphatics themselves proceeding to the enlarged gland, share this inflammatory induration, and sometimes feel like hard whipcord. Along the back of the penis, such cords may be felt leading to the groin, where generally, just above Poupart's ligament, lies the swollen, bullet-like gland. In the *female*, if a chancre be situated on the fore part of the vulva, this swelling is found at the external abdominal aperture; if situated posteriorly, then betwixt the labium and the thigh, inflamed lymphatic vessels lead to a swollen, hard gland in the groin. Commonly, more than one gland is affected, forming a *multiple* bubo, of small olive-shaped or globular tumours. Sometimes the bubo is situated on the opposite side of the chancre; or both groins may be affected, presenting double inguinal bubo. Chancres within the urethra, on the perineum, the anus, the mouth or neck of the uterus, the lower part of the abdomen, or the buttocks, are equally associated with *inguinal bubo*. But, when the vessels of absorption pass through other

glands, the bubo will be situated elsewhere. Thus, syphilitic bubo far down on the thigh.

Indurated bubo is *slow*; reaching its full development in ultimate duration varies from *several weeks* to five or

has (Bumstead), or may be prolonged even to a period of years.

Like chancre, it is thus essentially indolent and usually more so. It *terminates* by resolution: suppuration is a rare event.

INFLAMMATORY BUBO.—Arising from any cause of lymphatic irritation, commonly from gonorrhœa, this species of lymphatic glandular lesion is then named *simple* adenitis or *sympathetic* bubo; but as arising from chancroid ulcer, by the absorption of its virus, it may be called *chancroidal* bubo, being in fact a chancre of the lymphatic system.

It usually appears within a *fortnight* after the appearance of chancroid ulcers, one gland only, or sometimes more, presents a swelling in the groin, but the enlarged gland is somewhat *soft*, never indurated, and is *painful*, so that the patient walks with a limping lameness; in all these particulars from indurated bubo, in connection with

which the state may last for an *indefinite period*, as an *indolent* bubo; and it terminates by resolution, when resulting from simple adenitis. Or, the swelling enlarging, it engages the fascia and skin, whereby the tumour becomes adherent and fixed. *Suppuration* may then ensue from simple adenitis; and chancroidal bubo *always* proceeds to this issue. When the abscess bursts, or is opened, the resulting *ulcer* assumes all the characteristics of a chancre; its interior being overlaid with a greyish-yellow membrane, its margin undermined and vertical or everted, while from within the gland is *auto-inoculable*,—any abrasion of the surrounding skin thus reproducing a chancroid ulcer, or inoculation can be easily effected. Chancroidal bubo may be thus distinguished from simple adenitis, and from the indurated bubo of syphilis,—in the form of its suppuration.

Advanced Conditions.—The *ulcer* of *chancroidal bubo* may acquire all the characters of some common ulcer; as the *indurated* and *indolent*, the *inflamed*, the *phagedænic*, the *serpiginous* form of phagedæna, the *loughing phagedænic*. The three latter forms of ulcer, originally local, are more or less destructive; the ulcer sometimes increasing to enormous size, extending inwards over the perinæum, or upwards as high as the naval, or downwards on the thigh, while its depth threatens the femoral artery.

Retention of Specificity.—*Chancre* retains its specific nature for a considerable period, frequently weeks, sometimes *months*,—in one of my cases, probably eight months, during which time the sore can communicate the disease to an unaffected person. *Bubo*, however large, which arises from a chancre when about to heal, is simply a swelling of the lymphatic gland, which fails to supply virulent matter in the event of suppuration. *Chancroid*, or the soft, suppurating ulcer, mostly cicatrizes in the course of a *few weeks*; but the period of repair may be prolonged beyond, the sore retaining its virulent specificity of local contagiousness to the last moment of its existence; while, indeed, cicatrization being at the circumference, the pus is specific in the centre of the ulcer, and may propagate chancroid in a neighbouring part, or in another

Syphilis—Secondary or Constitutional.—The blood having been infected with the syphilitic virus, after the appearance of chancre with

induration, in the course of a *month* or *six weeks*, or a longer period, a constitutional disturbance—the *syphilitic fever*—ensues, in a degree more or less marked. According to the observations of Dr. Guntz, the period of its accession varies to within fifty and sixty-five days, in the natural course of the disease, unaffected by treatment; but that no fever appears within or even beyond that period, when, from immediately after infection, the patient has been brought under the influence of mercury, used internally or externally.

The *symptoms* of febrile disturbance are those of ordinary pyrexia; some acceleration of the pulse, a dry, hot skin, and furred tongue; succeeded by great debility, wandering pains, and gradual emaciation, with the wan sallowness of syphilitic cachexia. Occasionally, Guntz has known a violent rigor or shivering fit to precede the symptoms.

With the *accession* of syphilitic fever, various inflammatory modifications of nutrition are developed, which have a tolerably regular order of sequence, in different parts of the body. As manifestations of the blood-disease in operation, they are “secondary,” or even “tertiary” to the chancre and thence the bubo, which, proceeding from the original source of infection, constitute “primary” syphilis.

The slow-healing power of the primary ulcer, and of the bubo, when, as a rare event, it suppurates and forms an ulcer, somewhat suggests the prevailing character of these secondary manifestations. From the first moment of the pus-forming pimple, the whole career of syphilis is one of *disintegration* of the tissues, with an abortive effort of the reparative power by plastic *lymph-forming induration*. Disintegration, by desquamative or other destructive eruptions of the skin; disintegration, by corroding ulceration of the tonsils, tongue, lips, palate, and perhaps the nose; disintegration, by iritis, with molecular lymph; disintegration, by irreparable destruction of the texture of the testis; disintegration, by caries and necrosis. Premature baldness, fretting ulceration around the roots of the finger and toe nails, and a wan cachectic pallor, bespeak the consummation of syphilitic decay.

(1.) SKIN-DISEASES.—Similar eruptions—exanthematous or *rashes*, papular or pimples, tubercular, squamous or scaly, vesicular and pustular—arise alike, as manifestations of constitutional syphilis in the skin; and also under other circumstances. But, as modified by this disease, they are named *Syphilo-dermata*, or *Syphilides*.

1. *Roseola* or *rose-rash*.—The eruption which usually first succeeds the syphilitic fever, is of a rose-red colour, *not raised* above the surface of the skin, disappearing on pressure, and returning as soon as the pressure is removed. It arises in the form of more or less rounded patches, giving a mottled appearance to the skin; when examined closely, each patch is seen to be made up of a cluster of papillæ, more injected than natural. This eruption sometimes vanishes within a few days. If it persists, the papillæ forming each patch generally become visibly enlarged, and the colour of the eruption gradually changes to a copper hue. This colour is commonly all syphilitic eruptions which remain for any length of time without ulceration or ulceration; but it is not peculiar to (secondary) syphilis, it is not *pathognomonic*.

Others which follow this first efflorescence on the skin, exhibit various appearances.

papular eruption.—The papillæ of the skin are enlarged, in the form of *hard elevations* having a copper colour, which is removed by desquamation or resolution. These elevations may be scattered irregularly over the body, or collected together into groups.

Plastic eruption.—Effusion of plastic lymph having taken place, is organized, as in the papular eruption, but now in the form of *tense conical eminences*, covered with a red shining cuticle; and finally acquire a copper tint, and shed their shining silvery scales. The tubercles may be scattered singly over the surface, or collected into groups.

Scaly eruption, commences, like the mottled skin of roseola, with the effusion of circular groups of papillæ. The papillæ are at first small, but soon the whole *circular patch* becomes equally involved; and the disease takes place into the substance of the skin, which then presents a *scaly elevation*, the edges of which are sometimes raised higher than the centre. A copper colour, of a more or less decided hue, overspreads the surface, but it is often partially masked by a thin layer of cuticle, and shed in thin *white shining scales*, as in common lepra. Numerous small perfectly circular, may form on any part of the body. The syphilitic lepra sometimes much resemble flattened syphilitic

Triangular eruption—another *scaly eruption*—appears in the form of oval or triangular *patches*, slightly elevated above the surface. They are not defined at the centre, and are often traversed by *cracks* or *fissures*. A brown colour is often observable, but covered with epithelial scales of various degrees of thickness. This disease is much more persistent than the syphilitic lepra. It occurs on the *palms* of the hands and soles of the feet, or on any part of the body.

Vesicular eruptions, as manifestations of constitutional syphilis, are not identical with vesicular eruptions not of syphilitic origin. At the point of their origin only, we recognize *syphilitic herpes*, *eczema*, *impetigo* or *pompholyx*. In all, an effusion of serous fluid raises the surface into vesicles, or blebs—*bullæ*, which are simply large vesicles such as the last-named form of eruption.

Pustular eruptions constitute also an analogous class to the non-syphilitic. They may arise from the transformation of other eruptions, in the course of syphilis. Thus, the papular may change into the vesicular, and pass into pustular.

Proper pustular eruptions of syphilitic origin are divided by some authors into three kinds:—

Sydraceous pustules, which are either small and narrow, or of moderate size, elevated, and round. They have a *hard base*, and are surrounded by a *red-coloured areola*. The pustules are of a dull reddish hue, and increase in *successive crops*; showing examples of the disease in its activity, and decline. The pustules dry into a *small greyish crust*, which, when separating, may leave either a cicatrix or some injection of the surface.

Impetigo, preceded by slight malaise.—This eruption commences with a redness of the affected parts; then small collections of purulent matter form *irregular-shaped patches*, more or less *confluent*, resting upon a *coppery-red* colour, which are soon covered by *scabs* irregular in shape.

in shape, *harder, darker coloured*, and more *adherent* than those of non-syphilitic impetigo. Beneath these scabs are *ulcerations*, followed by scars, varying in shape and extent. This eruption more frequently occurs on the face, but it may affect any part of the surface.

(c.) *Ecthyma*.—The pustules are still larger,—the size of a shilling, or more isolated, and few in number; chiefly occurring on the limbs, and especially the legs. Commencing as *large livid spots*, the epidermis becomes raised over a considerable portion of each spot, by a greyish, sero-purulent matter, which increases slowly, and is always surrounded by a broad copper-coloured areola, unlike the violet-red of non-syphilitic ecthyma. After a few days, the pustules having broken, *scabs* form, which are of a *circular* shape, *dark* and *hard*; gradually increasing in thickness they fissure at their edges, and are very adherent and persistent. On separating, they expose *deep round ulcers*, with sharp-cut hard margins of a purple colour, whilst the bottom is greyish. The ulcers heal, leaving circular and lasting cicatrices.

This is the most common species of syphilitic pustular eruption, and that which is usually met with in *new-born children*.

Ulceration of the Skin in constitutional syphilis, may be either a sequel of some kind of eruption, or it may arise independently.

(2.) DISEASES OF MUCOUS MEMBRANES.—1. *Sore-throat* ranks among the earlier and less equivocal secondary symptoms. It may appear in one of three forms, according to the stage of the disease. (a.) *Tonsillitis*, in the form of *erythema*; a *diffuse, purple redness* of the arches of the palate and the tonsils, with some swelling, giving to the mucous membrane a velvety appearance. This may be attended with ulceration, more or less superficial; the surface then looking red and glistening, as if from an abrasion of the mucous membrane; or it is covered with a pellicular film, of a dirty-white or greyish-yellow colour. This ordinary sore-throat is met with in an early stage of syphilis,—from *three to eight weeks after chancre*. Apart from other symptoms,—usually an erythematous eruption of the skin, or roseola,—the throat affection might be mistaken for a common catarrhal tonsillitis. (b.) *Chronic congestion* of the tonsils, which may be slightly reddened, or have an ash-grey colour, and are much swollen and consolidated; the tonsils appearing as two *fleshy bodies*, roundish or perhaps somewhat *tuberculated*, and projecting across the throat, so as to almost close the passage. This chronic enlargement of the tonsils occurs at the fully developed stage of the secondary symptoms, or may be an early tertiary symptom. It bears a resemblance to scrofulous tonsillitis, but the co-existence of other manifestations of Syphilis is diagnostic. (c.) *Deep ulcer* of the tonsils. This form of ulceration is preceded by, and accompanied with, comparatively little pain, redness, or swelling; but the appearance presented is peculiar, and known, more especially, as “the ulcerated throat” of Syphilis. It is an advanced
sec

perhaps tertiary symptom; and may result from ulceration
e, or diffuse gummy infiltration.

bed is *circular* and *excavated*, with a sharp and pro-
verted, margin. The bed of this ulcer is sloughy and
sounding mucous membrane dusky red.

nd *milky stains* on, the *tongue* and inside the lips are
c, but the former must be distinguished from those

h accompany irritable dyspepsia, and the latter—opaque white ble aphthous spots.

doubtful are *mucous tubercles* situated on various parts of the *nasal membrane*, as the *tongue*, lips, palate, and tonsils. These e of a whitish colour, and may be seen also on the skin, in pale, *soft little cushions*, bedewed with mucus; the skin sur-uch tubercle appearing puckered around its margin. Such *condylomata*—are commonly found in secondary syphilis, ound the *anus* or on the *scrotum*; also, fretting along the the *external labia* in the female; perhaps on the perinæum, of the thighs, and on the groins. Sometimes these tubercles e axillæ; and, in fact, wherever ordinary tubercles are warm hey frequently become mucous tubercles, skin readily assuming nce of mucous membrane.

ation of the *nasal* mucous membrane, that of the hard and soft he *pharynx* opposite the mouth, and of the *larynx*, is liable secondary syphilis. These ulcerations are frequently accom- caries of the nasal bones, of the hard palate, even of the hind the pharynx, and necrosis of the laryngeal cartilages.

and discharges are singularly fetid. But the appearances of ozaena closely resemble those of venereal ozaena. *Chronic* ulceration of the *rima glottidis*, denoted by a broken lative cough and foul expectoration, may be a manifestation of nd grave secondary syphilis. Portions of the laryngeal car- the cornua of the thyroid cartilage, in an ossified state—are coughed up. But syphilitic laryngitis presents nothing pecu- characters, from first to last, whereby it can be distinguished e laryngitis under other circumstances. The symptoms just might follow laryngitis, from a common cold.

PHILITIC IRITIS is a not uncommon manifestation of secondary t *tawny* or *rusty colour* of the iris near its pupillary edge, is racteristic.

ENLARGEMENT OF THE TESTICLE occurs late, if at all, in the philis. (See SYPHILITIC SARCOCELE.)

MPHATIC GLANDS, in various parts of the body, are liable to larged, and their indurated enlargement, especially on the d back of the neck, is regarded by Ricord, I believe, as f secondary syphilis.

SEASES OF THE BONES, AND PERIOSTEUM, may be symptoms (secondary) syphilis.

syphilitic *node* is a chronic, hard swelling, without any redness in the first instance, nor for some time; eventually it becomes utely painful. The syphilitic virus appears to select certain ortions of bones, for the production of nodes; they are mostly as, as the inner aspect of the *shaft* of the *tibia*, the sub- ortion of the *ulna*, the *sternum*, *clavicle*, and *cranium*. Nodes n simple periostitis are softer, and evidently inflamed from encement. They are also more acute.

and *necrosis* rank as quite advanced secondary symptoms. *Wasting* of the bones, denoting *caries*, has its chosen seats; e where nodes are prone to form—on the *tibia*, *ulna*, *clavicle*,

elbow or ankle.

Tertiary Symptoms.—All the lesions are designated secondary. Some of them are on the skin, and the *deep circular ulcer* is a disease of the *testicles* and of the bones. Others previously described in the secondary stage affect the *nose, lips*, and roots of the hair.

(1.) A *tubercular nodule* may form a hard, hardened copper-coloured mass, varying in size from a line to an inch and more; persistent perhaps for years, and finally destroying the nasal cartilages, and producing a nasal fistula.

(2.) *Cracks* on either *lip* may appear after a few months, ulcerate extensively.

Ulceration about the roots of the hair produces a brown or black colour, surrounded by a redness, attended with a most offensive discharge. The ulcer, though commonly the former, may be the latter. The ulceration is very obstinate, and the nail falls out.

(3.) The *hair* may become dry, with brittle ends, or split at its extremities, and be shed, or fall out, even to baldness. If the bulbs are affected, the baldness is permanent, a condition which may be partial or entire; and affect the beard, or the hair on the head. In one case, recorded by Vidal, the hair on the head fell out.

(4.) *Skin-diseases* or *Syphilides*.—In the tertiary stage, eruptions, which, especially in the form of *condylomata*, *syphilides*, *rupia* is another such eruption, and *syphilis*.

Commencing as *pustules*, the size of a pin's head, and surrounded by a *dusky red areola*, containing a few integrated blood-corpuscles, forming blood, the pustule discharges or dries into a *crust*, which spreads *beneath*, circumferentially, but slowly, yet persistent. Suppuration is raised by the formation of a *pus*.

what *depressed, irregular cicatrix* is seen of a purple hue, but which ultimately becomes white.

(5.) *Gummy Tumours* are met with, consisting of cell-proliferation and degenerative transformations of connective tissue; having a yellowish-white appearance on section. They are of *variable size*—from a hemp-seed to a chestnut, but with an *ill-defined outline*, being perhaps thinly encapsuled, yet continuous with adjoining textures. The consistence of these tumours is tolerably distinctive—hence named gummy; they yield a *soft* or firmer resistance to the touch, or having undergone atrophy and conversion into caseous or perhaps calcified matter, the little mass becomes a *harder lump*.

Sometimes a gummy tumour is slowly *absorbed*, leaving a fibroid cicatricial remnant; but, commonly, when sub-integumental, *ulceration* or *sloughing* of the skin or mucous membrane supervenes, and discloses an ash-grey, sloughy lump—as of matted cellular texture, the integumental aperture having irregular, undermined edges or flaps, with surrounding bluish discolouration. Ulcerated subcutaneous gummata are thus met with on the scalp, back of the neck, thighs, and other parts.

The *parts* in which such tumours may be found are very widespread:—in the skin or mucous membrane, or seated in the *sub-cellular tissue*, and at length forming tertiary ulcers, as on the *tongue* or *soft palate*, or in the *pharynx* and *larynx*; in fibrous membranes, as the *periosteum*, or in *bones*, appearing as nodes; while, in the connective tissues of muscles, gummy tumours are not uncommon, as obscure growths; and in organs, more particularly in the liver, lungs, spleen, brain, spinal cord, and nerves, kidney, testicle, and breast, pancreas, stomach and intestines, heart and arteries, these formations constitute chiefly the syphilitic affections of *internal organs*.

Fibroid induration occurs in the course of advanced syphilis, as a cicatricial remnant of gummy tumour, or as an independent formation. Commonly affecting fibrous textures, such indurations are found in the *periosteum*, but most distinctly in muscle, and in the capsule of internal organs.

Lastly, a wan, yellowish hue overshadows the skin in an advanced stage of the disease, which is designated the syphilitic *cachexia*; but this may denote a mercurial deterioration of the blood.

Congenital, Hereditary, or Infantile Syphilis.—The term infantile syphilis is not intended to signify primary syphilis in an infant, communicated at birth, from a primary sore or chancre existing in the person of the mother. The disease referred to is truly constitutional syphilis inborn, and transmitted as an hereditary infection, from the mother at the time of conception or during the period of intra-uterine life. But constitutional syphilis in the mother, in the father, or in both parents, is not necessarily transmitted to the offspring; who may indeed be singularly free from any manifest constitutional syphilitic taint.

Syphilitic infection of the *ovum* appears so to lower its vitality, as to entail many morbid consequences. *Abortion* may ensue, at a variable period of pregnancy, the ovum never reaching maturity. Several consecutive miscarriages may thus take place, until the maternal or paternal state of infection is rectified or eradicated; when the mother will probably retain the *fœtus* for the full period of pregnancy—nine months, and then

give birth to a *living child*. From the time of birth, the infant exhibit symptoms of secondary syphilis, and present a cachectic, wasted, and, as it were, aged appearance. Or, free from any secondary symptoms at birth, they supervene in a variable period—a few weeks commonly between the *second* and *eighth week*—or, possibly, not until adult age. But after the eighth month, Trousseau affirms that the disease very rarely appears.

The *mode of communication* would appear to take place in either of four ways, or in their combinations:—(1) From constitutional syphilis in the father, and without communicating any apparent infection to the mother; (2) from constitutional syphilis in the mother; (3) from the parents; (4) from systemic infection of the mother, through a primary sore—a chancre contracted during pregnancy—the embryo having been quite healthy at the time of conception. And the liability of the foetus to infection is much greater during the *earlier period* of pregnancy than in the later months; an analysis of eleven cases by Diday testifies to the conclusion that, after the end of the seventh month, syphilis acquired by the mother is not transmitted to the offspring. But neither parent may exhibit any symptoms of syphilis, the disease having been latent for perhaps a period of many years. (Bumstead.)

The power of *communicating* the disease to offspring, from a constitutionally syphilitic parent, seems to *decline* in the course of pregnancy, and is perhaps at last eradicated. Thus, a man having had secondary symptoms, may afterwards beget a healthy child, his wife also remaining free from any constitutional taint of the disease. But re-infection is possible.

Many other questions pertaining to hereditary syphilis remain in doubt, and are disputed. *Firstly*, whether a mother, pregnant with a syphilitic foetus, the offspring of a father having the constitutional disease, can be infected through it without herself having had primary syphilis? Ricord answers this question in the affirmative, and the possibility of this mode of maternal infection is supported by a large amount of evidence collected by Mr. J. Hutchinson. *Secondly*, whether a wet-nurse, having the constitutional disease, can infect the child who suckles, through the medium of the milk? Yes, says Ricord; no, says Acton. *Thirdly*, conversely, whether a syphilitic child can infect a healthy nurse? No, say Ricord and Acton. But Hunter and Lawson relate cases in which several nurses have been thus infected, in succession, and two of whom transmitted the disease again to their own offspring. As to the mode of communication by *suckling*; any crack or abrasion of the nipple, or on the lip or mouth of the child, will facilitate transmission. But, according to Colles, mere *contact*, without excoriation, will suffice.

Symptoms.—Congenital syphilis is not indicated by any constant and peculiar symptoms taken singly, but collectively they are diagnostic. The order of development is uncertain. 1. The *cachectic, wasted, and withered* condition of the child usually attracts attention. The *face* is *muddy tinted*, or there is a tawny-coloured patch in the place of either eyebrow, from which the hair has fallen; the *skin is loose and wrinkled*, especially round the eyes, mouth, and nose, which also has a *flat* appearance; and the expression is remarkably *old-looking*, giving to

visage of the infant a monkey-like aspect. The *voice* or cry is cracked, like the sound of a penny trumpet.

Secondary symptoms are manifested by the skin, and mucous membranes—especially of the nose and mouth. 2. Congestion of, and offensive muco-purulent discharge from the *nasal* mucous membrane, are accompanied with a *puffed appearance* of the *nose*, and constant *snuffling breathing*, as a chronic catarrh, existing from birth, or soon supervening. The *mouth* may exhibit around the *lips radiating cracks or fissures*, with spots of ulceration, and milk-white patches may be found on the palate. 3. *Cutaneous eruptions* appear, before birth—the infant presenting some such eruption from birth, or not until some weeks have elapsed—usually three or four. Certain parts are affected more particularly; the *mouth* and *anus*, the *nates* or *scrotum*, the *palms* of the hands and the *soles* of the feet. Hence, observation should always be directed to these parts, in examining an infant supposed to be the victim of hereditary syphilis. The congenital eruption may be recognized in the form either of mucous patches, of a spongy, oozing character, especially besetting the angles of the mouth and perhaps the fauces, or gathered around the anus; elsewhere the eruption may be that of roseolous spots, which come and go; or the cracked appearance of psoriasis may be presented, more especially in the inelastic skin of the palm of the hand and the sole of the foot; sometimes the eruption takes the form of flat, squamous tubercles; or vesicles or bullæ, known as pemphigus, which dry into scales or scabs. A *brownish-red, coppery* colour, of or around these eruptions, is more characteristic. 4. *Iritis* is not uncommon; this affection occurring in about five or six months after birth, and being attended with an abundant effusion of lymph, occluding the pupil so that the sight is generally lost. *Interstitial corneitis* usually appears, but at a later period,—between the eighth and fifteenth years. 5. Syphilitic periostitis and caries are comparatively rare; but sometimes the bones lose their epiphysial connections.

6. The *teeth*, both temporary and permanent, are affected in the tertiary or later form of congenital syphilis. Certain *carious* or *ill-developed* appearances are presented. The *temporary* teeth are cut early, have a bad colour, and are liable to a crumbling decay. The *upper central incisors* usually undergo this destructive change early, and always first; then follow the lateral incisors, which become carious and are shed; lastly, though rarely, the canine teeth wear away, so as to assume a flattened, *tusk-like* character. Owing to early decay of the incisors, the syphilitic child remains edentulous from an early period, in regard to these teeth, and has a remarkably unsightly appearance in the laugh of childhood, until the permanent ones are cut. The *permanent* teeth are more peculiarly affected; chiefly the *upper incisors*, and first the *central* ones. They are discoloured, short, peggy, rounded at the angles, standing apart with interspaces, or converging; and marked, on their margin, with a *deep broad notch*. They readily disintegrate, crumble, and wear down.

The *prognosis* of congenital syphilis may be determined mainly by the more or less early supervention of the symptoms of the disease. A withered tawny-faced infant *at birth*, and affected with snuffling and nasal discharge in the course of a day or two, will probably die. The

difficulty of suckling such an infant,—for the act of suckling is imperfectly performed, the supply of milk from the diseased mother may be poor and scanty, and the substitution of a healthy wet-nurse would be obviously improper—the difficulty of weaning the infant to food suitable to its weak digestion and assimilation, and the oppressed respiration under which the child labours, are all very unfavourable to the renovation of nutrition and ultimate recovery. Whereas, when the infant remains free of syphilitic manifestations after birth for a period of *two months* or longer, and is then affected with symptoms,—when the syphilis is hereditary rather than congenital, it is probable that nutrition will have become sufficiently established for the child to outlive the disease, and perhaps also the liability to its return.

But the *mortality* from congenital syphilis is far higher than that from the acquired disease. Bassereau is led to believe that in at least one-third of the congenital cases, death ensues with a few months after birth.

The *Treatment of Congenital Syphilis* will be mentioned in connection with the general Treatment of Syphilis.

Vaccino-Syphilitic Inoculation.—A most important social question is, whether a true chancre—an infecting syphilitic sore—can be communicated by vaccination, through the vaccine virus? Dr. Viennois, in 1860, brought forward cases, apparently, of such syphilitic transmission; other cases subsequently occurred under M. Trousseau, in the Hôtel Dieu; and, since, at Rivalta, an overwhelming demonstration occurred, one child, thus infected, having re-transmitted the disease to another child, and thence, through both, to forty-five other children, and to twenty other mothers or nurses! In this country, the observations of Mr. Thomas Smith and of Mr. Jonathan Hutchinson have since borne corroborative testimony as to the possibility of vaccino-syphilis. But in the event of transmission to a *third* person, by vaccination, Mr. James R. Lane disputes the possibility of infection having occurred some time *before* the intermediate individual has manifested constitutional symptoms. Waller, of Prague, affirms that the *blood* of a syphilitic individual is contagious.

Syphilitic Infection.—The various conditions under which Syphilis may be communicated, may perhaps be expressed as follows:—

- (1.) That a chancre always produces a specific virus.
 - (2.) That all chancres—hard and soft—are capable of being propagated by inoculation.
 - (3.) That inoculation with the serum or lymph from an indurated sore will only produce a chancre, and that an indurated one, when the system is unaffected. During, therefore, only the earliest stage of such chancre—*i.e.* prior to induration, which may be regarded as the first secondary symptom.
 - (4.) That an indurated sore being irritated may become a suppurating sore; and that matter so obtained, may, by inoculation upon the individual from whom it is taken, produce a soft sore—*i.e.* the suppurated sore is auto-inoculable. (H. Lee and Böeck.)
- inoculation from an indurated sore—the system being invariably followed by secondary affections.
 inoculation from a soft chancre is less certainly productive of
 ions.

(7.) Secondary syphilis may be propagated by inoculation. The propagation of the constitutional disease through the seminal fluid of syphilitic man, by habitual intercourse with a woman, is doubtful.

(8.) But, that inoculation from secondary syphilis is inoperative on an individual himself, or upon another individual having secondary syphilis.

(9.) That the secretion of other specific diseases existing in syphilitic subjects (including the specific syphilitic pustule, and the sores which result from it), has no power of imparting constitutional syphilis. (H. Lee.)

(10.) That the natural secretions of glands in syphilitic subjects, when those glands are not themselves specifically diseased, have no power of imparting constitutional syphilis. (H. Lee.)

Treatment.—PRIMARY and LOCAL VENEREAL ULCERS.—The first consideration in the treatment of syphilis is the question of the prevention of systemic infection. (1.) *Chancre*.—The early destruction of chancre, within the first four days after contagion, and thence the prevention of systemic infection, was known as the abortive treatment of syphilis; if primary syphilis being thus anticipated, the secondary or constitutional form of the disease would not follow. Accordingly, cauterization and excision of the chancre have both been advocated and practised. But, considering the long period of incubation of the syphilitic virus,—from two to three weeks as the average time, from the very beginning of which absorption must have proceeded—and the fact also, that when chancre is produced, the system has already become infected, it will be obvious that any local treatment which shall be preventive or abortive of syphilis must be extremely improbable. Destructive cauterization has proved successful during the incubatory period,—as early as four or five days after the sexual intercourse; and, as applied within only a few hours after the development of chancre, it has failed to avert the constitutional case. Former cases of supposed success were probably those of the locally contagious, soft suppurating ulcer.

(2.) *Chancroid, the Local Contagious Ulcer*.—The period for the destruction of this ulcer after contagion is of short duration; from two to four days, or within a week. Preventive cauterization must, therefore, be had recourse to within that time. Subsequently, however, the same treatment is available to prevent the propagation of chancroid.

Cauterization, to be effective, must be, not a slight superficial application, which only destroys the surface of the ulcer, but cauterization, deep, broad, and destructive. The *escharotics* most reliable are therefore mineral acids, sulphuric and nitric, chloride of zinc, potash and lime combined in the form of Vienna paste, pernitrate of mercury, and the actual cautery. Of the other agents, sulphuric acid, mixed with finely powdered charcoal—the carbo-sulphuric paste, as originally employed by Boerhaave—is a very effectual caustic. Chloride of zinc and flour, in equal parts, forming Canquoin's paste, is also very serviceable. Either of these caustics may be used with a glass rod, or a glazed crockery spatula. The caustic must be applied over the whole sore and around, so as to include the infected peripheral zone of tissue beyond it. The effect of cauterization should be limited within due bounds, if necessary, by means of some antidote; as a solution of carbonate of potash, after an acid caustic, or an

Excision is rarely so successful as cauterization. Even when performed freely enough to insure extirpation, and with the precaution of removing any contagious matter, the wound is liable to become re-inoculated, forming a larger contagious sore than the original one. Hence, removal of the scissors or knife is eligible only in certain parts; as in the case of chancroids fretting the margin of the prepuce or the border of the vulva, where the instrument can be carried sufficiently wide to destroy the ulcers. The fresh surface should then be touched with caustic, to form a protective eschar.

Phimosis, complicating sub-preputial chancre or chancroid, or a congenital malformation, or acquired by induration or inflammation and engorgement. Destructive cauterization can be of no use, when the disease thus enclosed, has become indurated, systemic infection having been taken place; and with *chancroid*, the phimosis being of an indurated character, any such treatment might induce gangrene. But it should be regularly cleansed, by syringing the prepuce with tepid water, or with a weak astringent solution, as the nitrate of silver, five grains to the ounce. The operation for phimosis—that of slitting the prepuce—in order to make any direct application to the chancroid, is an improper procedure, from the liability of thus converting the chancre into a larger chancroid ulcer, cases of which have happened.

It will be observed that the abortive treatment of chancroid, not being thus controllable, has regard not only to the local disease affected; it is also the surest preventive measure, socially considered, in extinguishing the source of contagion.

CURATIVE LOCAL TREATMENT.—(1.) *Chancre*, as a specific sore, is best treated by mercury. It may be applied in the form of mercurial ointment, spread on lint, and laid on the sore; or as a lotion—the lotion consisting of calomel and lime water, in the proportions of 3℥ of the lotion, or, by calomel fumigation, locally applied, as suggested by Sydenham. Five or ten grains of calomel may be volatilized over an alcohol lamp, and the ulcerated part should then be held over the vapour, until the white powder is fully deposited on the surface, where it must be allowed to remain.

durated chancroid—the *phlegmonoid* form—is not
er condition, the inflammatory character must be
ion of cold lotions, or poultices, and other anti-

ration comparatively seldom attacks *chancre*, and is
ary symptoms of the most severe and intractable
m of rupia, chronic periostitis and osteitis, sloughing
roat and nose. Phagedænic *chancroid* is not infre-
se, the ulceration may have the creeping and per-
inous phagedæna, spreading to an unlimited extent.
ises free *cauterization* with strong nitric acid, or the
m, tonics, and a supporting diet; a temperate, quiet
licord speaks highly of the potassio-tartrate of iron,
r. Lee, both as a tonic and local application. A
ounce of this salt to three ounces of water may be
doses of a tablespoonful, an hour after meals; and
to forty grains to the ounce of water, applied to the
Permanganate of potash, a drachm and a half to the
ed by Hinkle. Iodoform, powdered on the ulcer, has

The co-existence of *phimosis*, with sub-preputial
occurs; and then the foreskin must be slit up, to
d.

Ingrenous chancroid is not uncommon, and more
is affected. The part is struck with pain, and the
appears of a greyish hue, deepening into greenish
a dusky-red inflammatory areola. The discharge
sometimes, this destruction *en masse*, supervenes on
gration, and worm-eaten appearance, of *phagedæna*;
mixed character.

enfeebled constitutional condition, the treatment
application of *nitric acid* to the ulcer; but the
be renovated by quinine, perchloride of iron, and
as the patient can digest,—often the main difficulty

rated *Bubo*, and (2) *Soft Bubo* preventive treatment
systemic infection has already taken place; in the
reference to the causative chancroid—cauterization.
o should speedily be advanced by poulticing, and
y; before the formation of sinuses, which would
bluish integument, leaving it indisposed to cicatrize.
y slit open with a curved, sharp-pointed bistoury or
o make a free incision, and in the vertical rather
d direction, as the former cut allows a gaping outlet
tter when the thigh is raised. Any sinuses should
with a director, and laid open. If the *glands* at the
appear isolated or pedunculated, they had better
ead of being extruded by a tedious ulceration. This
e knife or scissors, or by touching the little mass
of potassa fusa. Hæmorrhage is seldom much, and
The ulcer of the opened abscess always assumes a
er, and secretes virulent matter. A poultice is

applied, or strips of wet lint, to the bottom of the cavity, and the sinuses; subsequently this dressing should be exchanged for the lotion applicable to chancroid, or in its varied conditions of inflammation phagedæna. During the cicatrization of a healthy sore, this process of healing will often be promoted by the support of a compress and splint bandage, and in all cases by keeping the patient at rest. No particular constitutional treatment is required, and mercury would certainly be prejudicial.

In the rare event of *indurated bubo* having suppurated, the treatment is the same; but the constitutional influence of mercury in such cases renders every other general treatment may be employed with advantage.

Constitutional Syphilis.—In the treatment of Syphilis, it is generally acknowledged that this constitutional disease—like some others—evinces a strong tendency to *self-recovery*. But of remedial agents, *mercury* holds the first place, and *iodide of potassium* the second, in the present anti-syphilitic *materia medica*. It would be impossible to enumerate all the various remedies for constitutional syphilis which have been tried and failed, more or less entirely. Such as *sarsaparilla*, *guaiacum*, *opium*, *conium*, *juniper*, *sassafras*, *dulcamara*, &c.

Mercury seems to produce a systemic condition which is antagonistic to, and incompatible with, constitutional syphilis, in most of the forms of its manifestation.

The *symptoms* of the systemic influence of mercury, and of its efficient operation remedially, are, a slight tenderness of the gums adjoining the teeth, with, perhaps, a slightly increased flow of saliva, fetor of breath, and a coppery taste in the mouth. But this degree of salivation must be maintained, until any secondary symptoms, whether as regards the skin, the throat, or the eyes, have entirely subsided; including the induration of the primary sore.

The *administration* of mercury is a matter of equal importance, scarcely less so, the *kind* of mercurial preparations employed. It may be introduced into the system, through the gastro-intestinal mucous membrane, by pills or solution taken internally; or through the skin, by the rubbing in of ointment—inunction; or by exposure to vapour, known as fumigation, or the mercurial bath; or by inhalation. Signs of its advocates hypodermic injection.

Blue pill—*pilula hydrargyri*—from three to five grains, two or three times a day; or calomel, a grain or more, in the form of a pill, and taken as often; have long been favourite forms of administering mercury. A small proportion of opium—say, a quarter of a grain—combined with each pill, will tend to make the blue pill or calomel settle on the stomach. The *iodide* of mercury, combined with opium in the form of a pill, is the preparation which I have long been in the habit of prescribing, as it is less irritating to the stomach, and equally remedial. The *hydrate of mercury*, *bichloridi*, in half-drachm doses, more or less, is a convenient form of administering mercury internally; but I use it rather to surmount the systemic influence of the iodide.

Mercurial inunction supplies a more sure method of affecting the system without any collateral disturbance of the digestive organs. The blue ointment, *unguentum hydrargyri*, may be rubbed in, night after night, until the gums are touched, and the second

evidently subsiding. The ointment must be rubbed in until it disappears, and then the greasy surface should be left unwashed.

Fumigation may be preferable as a more cleanly and equally efficacious mode of introducing mercury through the skin. It consists in exposing the surface of the body, enveloped in a blanket up to the neck, to the fumes of some mercurial powder, which is heated until it is in the form of vapour, and which can be advantageously associated with a vapour bath. A more ready contrivance is a half brick, heated to a dull redness, on which the powder is placed, and set in a shallow dish containing a little water. *Calomel* is the mercurial preparation employed; and *fifteen* or *twenty* grains, the quantity usually employed, will undergo volatilization, entirely, in fifteen or twenty minutes. The patient is then put to bed, so that the particles of calomel may be wiped off the surface of the body.

Inhalation can be administered by a simple and efficient apparatus, which is easily constructed; a common earthen teapot, of which is attached a tube of vulcanized india-rubber, about an inch long, and provided with a bone mouth-piece, in shape like the mouth-piece of a meerschaum pipe. A *scruple* of *calomel* is placed in the bottom of the little hole in the lid which allows the escape of steam is secured by a peg of tightly rolled paper. Explosive coughing is apt to be followed by bronchitis.

The mercurialization produces symptoms which may be hereafter described. They are: profuse salivation, swelling of the salivary glands, sore throat, and face, ulceration of the mucous membrane, loosening of the teeth, and even necrosis of the jaws. Diarrhoea, with biliousness. Certain varieties of skin-diseases, *e.g.* mercurial eczema, and ostitis, otherwise than connected with the mouth. Low spirits, great prostration or mercurial erythema. Nervous affections—tremor, paresthesia, partial paralysis, or mercurial tremor, sometimes fatal paralysis and death; usually observed in those subject to the mercurial fumigation.

of potassium.—Not to be trusted for the prevention of constitutional syphilis, iodide of potassium ranks next to mercury as a remedy; and especially in some forms of the disease, and in a constitutional condition, whether natural to the individual or whether here the action of mercury cannot be borne.

It may be stated generally, that in the forms of *skin-eruption*, accompanied by *plastic induration*, in the earlier period of constitutional syphilis, and in young and vigorous subjects, *mercury* is most curative; in *pustular eruptions*, *enlargement of the testicle*, *periostitis*, and any *tertiary affections*, in the later periods of syphilis, in debilitated, cachectic subjects, *iodide of potassium* is the more efficacious. But, perhaps, it may be added that its effects are less permanent than those of mercury, and thus the disease is liable to recur. Iodide of potassium is given in doses, usually from three to five grains, three or four times a day, or perhaps half a drachm, thrice daily, and combined with bark, cascarilla, or other vegetable tonic; this adjunct generally visits under the circumstances of suppuration or ulceration, when iodide is prescribed.

Cascarilla has far less influence on constitutional syphilis than was

the hand, a substitute for iodine
anti-mercurial. The decoction
it must be concentrated, and dra
wine-glassful three times a day
with iodide of potassium, the t
named an "alterative" mixture.
but less so than bark, and it is sa
compound influence may give sa
purely tonic operation of cinchona
iodide of potassium. The cachect
the secondary or tertiary syphilit
dition, for which the various prepar
will be beneficial. Iron and quinin
tinued administration of iodide of
specific treatment.

Guaiacum—another overrated m
syphilis—is nevertheless, apparently
stances to those which render sarsa
preferable to mercury.

The *treatment* of the various *L*
Syphilis, is covered for the most pa
constitutional disease, as already cons

Syphilitic "sore-throat."—In ordi
matous inflammation is best treated
application of *nitrate of silver* to tl
coupled with constitutional treatme
chlorate of potash or borax may be u
congestion and *enlargement* of the tor
lant treatment; but the topical ap
fumigation, answers better than nit
calomel, mixed with an equal propor
the volatilization, may be directed
fumigator, night and morning. The
syphilis, should be promptly treat
progress may some

ly judicious restriction by allowing an interval of three years from the end of the primary stage of the disease, and that the patient shall have remained free of any syphilitic manifestation for the period of *one year*; but even then the patient should be warned of the possibility of a relapse.

(c) When a *syphilitic male* patient is *already married*, but his wife is *pregnant*, the husband should be candidly told of the risk of his transmitting the disease both to his wife and offspring; and he himself should be placed under specific treatment. When, unhappily, there is a reason to believe, or suspect, that the woman is infected, *she*, also, should be treated accordingly, with the view of preventing abortion, or the transmission of the disease to the *fœtus in utero*. This timely intervention may be accomplished only by a course of mercury. And it is better to administer mercury externally, by inunction, or by fumigation, rather than internally, by the mouth; for in the latter way, the treatment is apt to be defeated by the occurrence of diarrhœa, which might induce abortion. In marriage, perhaps on a second or third occasion, having been thus protected, the *fœtus* is tolerated *in utero*, to perhaps the full period; and then is born healthy, and continues free from syphilis. But in the case of there being congenital disease, namely at birth, or shortly afterwards, the same treatment should at once be resorted to, for its *curative* effect.

(d) The *infant* should be treated as a separate being, and protected from the possibly contaminating influence of the mother, if she suckle the child—as morally she is bound to do, rather than that the unwarrantable risk should be incurred of infecting a healthy wet-nurse by the child. If the mother be weak, and thus physically unable to suckle, the infant should be weaned. *Mercurial inunction* may be conveniently applied to the child by Sir Benjamin Brodie's method; the mercurial ointment, in the proportion of a drachm to an ounce of lard, is spread over a flannel roller, which is bound round the waist once a day. The child is kept about, and the cuticle being thin, the mercury is absorbed. It does not either gripe or purge, nor does it make the gums sore, but it cures the disease, and without fail. Very few children are said to recover, when mercury is given internally. But if this mode of administration is adopted, the hydrargyrum cum creta is perhaps the most efficient preparation, in congenital syphilis. The weakly child should be weaned, and reared artificially with more nourishing food; cow's milk, and perhaps veal or chicken broth.

The *local* treatment of the syphilitic eruptions, cracks and fissures, requires the application of slightly stimulating ointments and lotions; scrupulous cleanliness, by sponging the fundament more especially, and the use of clean linen.

CHAPTER VI.

ERYSIPELAS.

Erysipelas is a blood-disease, manifested by a diffuse and spreading serous inflammation of the skin and subcellular texture, possibly also the mucous membranes; and of an infectious character.

Simple or Cutaneous Erysipelas.—The inflammation is located principally in the papillary layer and rete malpighii of the skin. (roth.) It is here that the capillary blood-vessels are most engorged, white blood-corpuscles emigrating freely into the interstitial fibrous texture of the corium. The lymphatics, in the upper layer of the corium, are crammed with granular cells, and surrounded with masses of them. Commencing in the integument of the head or face, simple erysipelas exhibits the following characteristic appearances:—On the nose, cheek, the margin of either ear, or sometimes on one of the temples, a slight blush of redness becomes visible, accompanied with stiffness rather than swelling of the skin; which has lost only its wonted suppleness, and acquired a *shiny roseate hue*. A tingling, burning sensation also, rather than pain, is experienced, and hence the popular name of this inflammation—*St. Anthony's Fire*. The redness of erysipelas assumes different tints; usually being more scarlet, rather than purple; but of whatever tint it may be, it disappears entirely on pressure, and returns immediately the finger is withdrawn—so free and persistent is the determination of blood. The tension also of the skin is readily perceived on passing the finger from the sound to the inflamed part. An *abrupt margin* divides this redness and this stiffness; both are circumscribed by an irregular line. This definite outline is more marked where the redness is extensive, and is sometimes preceded by tongue-shaped projections in advance; where around the part the redness merges more into the natural color of the adjoining skin.

The inflammation, thus mapped out, *spreads continuously*: erysipelas, *par excellence*, a creeping skin affection; and while it diverges, creeps like water spilt on an impervious surface, the skin becomes swollen, serum is effused into the subcellular texture also, and this swelling is increased and diffused. Nature makes no adequate reparative effort to limit the inflammation, but circumscribes the serum with lymph.

Terminations.—At this stage of the inflammation its course is sometimes arrested, the redness fades into a yellowish-brown tint, and the swelling subsides, giving a wrinkled appearance to the skin; and termination by *resolution* occurs with, or without, shedding of the cuticle in silky scales, or a branny powder, at the end of three or four days. If the *serous effusion*, having continued for a period varying from twelve to thirty-six hours, elevates the cuticle into vesicles, or larger blebs, exactly like those which follow a burn or scald. These semi-transparent vesicles, yellowish, or sometimes livid blisters, soon burst, and discharging their contents—serum, pure or bloody—subside into thin incrustations. Within the course of a week or ten days, these peel off, they disclose the skin either in a sound state or beset with superficial ulcers.

Suppuration, in the form of small subcutaneous abscesses, sometimes occurs. In some instances the true skin is less spared. It has a reddish-brown or livid hue, and even *gangrene* of the skin succeeds; announced by great tension, heat, and acute pain. But this issue of erysipelas is rare, and generally fatal.

Diagnosis.—It is highly important to distinguish *simple* erysipelas from certain other diseases, which bear more or less resemblance to this cutaneous inflammation.

(1.) *Erythema* is an inflammatory affection of the skin, which presents a pale rose colour, with slight tension of the skin, and is attended with a tingling or painful sensation; but this inflammation appears in the form of irregularly circumscribed patches, of variable extent and number, and which have not the spreading character of erysipelas. Any part of the body is liable to be attacked with such patches, but the trunk or limbs are more commonly affected; rarely the head. The accompanying febrile symptoms are slight. Erythematous inflammation is transient, subsiding with efflorescence, in a week or two; or it may assume a chronic character. The varieties of erythema are distinguished principally by the shape, size, and colour of the flattened patches; in one variety, however, *E. nodosum*, the patches are elevated, and somewhat indurated, in the form of oval and more or less firm swellings, to the extent of two or three inches long, and which have a red or purple hue. They are commonly seated on the shin; and so far might be mistaken for syphilitic nodes.

(2.) *Urticaria* differs from erysipelatous inflammation, in its wheal-shaped eruption, accompanied with a *nettle-sting itching*; and the simultaneous affection of portions of the integument, in *different parts* of the body.

(3.) Certain *diffuse* inflammations of the subcutaneous cellular texture more nearly resemble simple erysipelas in appearance. *Capillary lymphatitis* appears in the form of a *uniform* blush of redness, unlike the ramified streaks presented by the larger lymphatics when inflamed; the redness is of a *pale rose* tint, and is accompanied with little or *no cutaneous lesion* to the touch of the finger,—these two characters differing so far from those of simple erysipelas, to which perhaps may be added the *less-marked boundary* of capillary lymphatitis; yet in *both* diseases the inflammation has the same continuously *spreading* character. But in respect to their causative origin, the distinction is most manifest; erysipelas generally being communicated by infection; whereas capillary lymphatitis is *always* of *traumatic* nature,—as a diffuse subcutaneous inflammation of the smallest lymphatics, proceeding from an open wound, or even a subcutaneous lesion, perhaps only friction of the skin. Traumatic erysipelatous inflammation arises only in connection with a *wound*; and, indeed, it may be doubted whether, usually, the traumatic erysipelas, so called, is not essentially capillary lymphatitis. From erythematous inflammation of the skin, capillary lymphatitis may be distinguished by its not appearing as numerous patches, and in different parts of the body, but only in connection with the local lesion, from whence it arises; and by the spreading character of the inflammation.

Phlegmonous, or Cellulo-Cutaneous Erysipelas—and its *Diagnostic Characters*.—Another form of the inflammation—*phlegmonous erysipelas*—presents different characters from those of simple erysipelas.

of resemblance. In *both*, the redness of the inflammation *extends* itself *continuously*. But then again, in phlegmonous erysipelas the cellular texture advances and deepens, and itself diffused, the stuffed cushion of a few small vesicles only represent the danger, as they do not reveal the perilous state.

Terminations.—Burrowing suppuration, these dangers *not* being attended with suppuration, pointing, as in phlegmonous inflammation, diminished tension, subsidence, and fluctuation.

Diagnosis.—Two forms of inflammation of the cellular texture—the one diffuse, the other circumscribed—distinguished from phlegmonous erysipelas by a diffuse, cedematous, and spreading cutaneous inflammation; there being present a great deal of redness in the skin, although the cellular membrane takes place rapidly in shreds or skeins, or mats as of wet tissue, extending over a whole arm, or down the trunk. The skin may become secondarily involved in blood-poisons. Thus, the etiology of erysipelas comprises the blood-poisoning from a snake bite, in the idiopathic form of the disease, and from a surgical operation. But the disease does not arise from infection, or to have an infectious character, resemble those of erysipelas; but the treatment is in common.

(2.) *Phlegmonous inflammation* consists in certain particulars, and which determine its much importance. *Coagulating lymph* is the phlegmon; the consequent swelling is the result, instead of being diffused and wide-spread. For instance, that of phlegmonous inflammation of the

however, the premonitory symptoms are simply a sense of weariness with a chilly feeling, ere the cutaneous or cellulo-cutaneous inflammation is declared. But in either case, the gastric and hepatic derangements are denoted by a yellow, flabby, steaming tongue, which soon assumes a dry, brown, and corrugated aspect, with bitter, hiccupy eructations, nausea, and epigastric oppression; the bowels are constipated, or pass only lumpy, dark-coloured, and offensive motions, issuing in diarrhoea; while a yellow tinge overspreads the skin and conjunctivæ. This retention of bile in the blood is shown also by the state of the urine, which has an orange-red colour; the secretion is scanty, turbid with lithates, and loaded with urea; sometimes a varying proportion of albumen is found on examining the urine with the usual tests of heat and nitric acid. On the accession of the fever, the pulse increases in frequency, to 100, or 120, sometimes to 140, and the temperature rises from 98° to 100°, 102°, or higher, during the apparent coldness of the rigor stage; but soon the supervention of exhaustion is manifested by the feeble, irregular, and liquid or thready character of the pulse, which often, however, retains its rapidity. Symptoms of *nervous depression* are evinced by the claspings headache and drowsy sleeplessness, which may be noticed in erysipelas of the head and face, more especially; and sometimes, maniacal excitement having prevailed for a time, the low muttering and wandering delirium of typhoid fever overwhelms the patient, as he sinks into the arms of death. On the other hand, there can be no more favourable omens than a subsidence of the pulse and temperature.

Pending erysipelas of the *head and face*, a diffuse inflammation of the fauces, or "sore-throat," generally precedes, and accompanies, the cutaneous inflammation. Swelling and tenderness of the lymphatic glands may be the forerunner of an erysipelatous outburst in an adjoining part; as of the cervical glands with relation to erysipelas of the head and face. A wound or ulcer assumes an unhealthy character; the granulations losing their florid hue, and the purulent secretion becoming thin and sanious.

Causes.—1. INFECTION.—Erysipelas may be caused by infection—*i.e.* it may be produced by inhalation, from a person having the disease. But this mode of production is observed only in some cases.

The evidence in favour of propagation by infection is manifested yet more clearly, when a person already affected with erysipelas, and who has imported the disease to others, is removed to another locality, and there also again propagates the infection.

But if the fact of persons acquiring erysipelas, after associating with those who have this disease, is in favour of its propagation by infection, when the source of contamination is removed, the disease should cease to spread; and of this there is abundant evidence.

Are *fomites* capable of transmitting this disease? Yes, certainly. Erysipelas may be caught by a patient, in consequence of being laid in the unchanged bed of one who died of it. The contaminating power of fomites, in the shape of furniture, floors, etc., is evinced by the fact that dry-scrubbing instead of washing the floors of an hospital, or the decks of a ship, is the surest safeguard against this source of infection. But fomites of all kinds retain most tenaciously the poison of erysipelas.

The period of *latency* or *incubation*—varying in each kind of infectious disease—in erysipelas, extends from two to fourteen days; and

besides spreading from a patient's surrounding atmosphere, or being exclusively infectious and contagious, the fluid contained in the vesicles, the tissue, is perhaps more especially as Doepp has shown, the vaccine at a later stage than the inflammatory disease is undoubtedly contagious. It has a contagious character. König's patients as had been subjected to operation were used that previously were saturated. After removing this apparent source appeared. Nor is the dead body a source of contagion, or infection.

MacLagan and Rogez record each a case of the post-mortem examination of patients who had been affected with the disease; apparently around the dead body, for there was no evidence of contagion.

2. EXTERNAL CAUSES.—Independently of the internal causes, there are several kinds of wounds, injuries, surgical operations, blisters, caustics, etc.—are accredited causation. Besides mechanical and chemical causes, be accorded their share of importance.

Trousseau recognizes no distinction between the origin and idiopathic erysipelas as an acute disease, according to his experience, the inflammatory lesion, however slight, and thence secondary. Thus, in facial erysipelas the starting-point is the ulceration in the nose or mouth, the ear or the eye.

The situations or parts of the body in which traumatic erysipelas may be met with are in the following:

any hospitals and transport ships where patients are sometimes un-ably crowded together, and under the most unfavourable circum-ces of suppurating wounds, erysipelas may be almost unknown, while ic infection is a frequent visitor. *Defective drainage* is, however, re potent source of erysipelas. Sewage emanation, therefore, may source of infection, in the production of erysipelas. So also pro- may be other kinds of decomposing animal matter. Thence, the *only dressing* of wounds is an accredited source of erysipelas, and of ropagation.

PREDISPOSING CAUSES.—Any external cause may be reinforced, at , by conditions within the body; resulting mostly from previous s of *intemperance*, previous hardships, or both, perhaps also from al depression—circumstances which have depraved the blood and bled its circulation. *Diabetes* predisposes to erysipelas. But the se is also most prevalent in spring and autumn, or at least when hot cold wet weather alternate; and if *period of the year* has some sposing influence, so also has the *period of life*, they being most liable are old in years, or old for their years.

astly, the possibility of erysipelas arising *spontaneously*—that is to in an individual without any assignable external cause, and therefore out infection—is, I think, indisputable.

The recurrence of this disease in the same individual is possible. Un-most eruptive fevers, the blood does not lose its capability of under- g this infection, again and again.

Prognosis.—In persons of *intemperate habits*, and who are the subjects egeneration of the kidneys, with albuminuria, or of the liver, with a ency to jaundice, erysipelas is generally fatal. In the *aged*, or ons of prematurely old and broken constitution, the prognosis is vourable. *Simple* cutaneous erysipelas is less perilous than the gmonous or cellulo-cutaneous form of the disease; but, as affecting head especially, or the trunk, the danger is greater than when either s is the seat of the inflammation; although the destructive character hlegmonous erysipelas, in the course of suppuration and sloughing, prove fatal by exhaustion.

Treatment.—*Preventive* measures must have reference to the causes his disease. Its propagation by infection suggests the prompt *isolation* any person having erysipelas—as the source of infection, free ventila- of the apartment, and the separate use of any bedding or other infected cle, which might act as a *fomes* in carrying the disease to other patients. -scrubbing instead of washing the floor of the bedroom or ward, has dy been alluded to as a safeguard; evaporation favouring, appa- lly, the dissemination of the infected atmosphere. *Cleanliness* with ard to the dressings used for other patients, and on the part of the ses, is an obvious injunction. With all these precautions, a nurse or practitioner himself may yet be the medium of communicating the ase. *Disinfectants*, such as chlorine vapour, or chlorinated solutions, manganate of potash, and carbolic-acid lotions, have more or less uence in purifying a contaminated atmosphere, or in guarding the nds of patients who may be exposed to its operation.

These preventive measures are less urgent with reference to erysipelas raumatic origin.

Debility, and the increasingly type of the commencement of the disease, soon substituted a *stimulant* and *tonic* in five or ten grain doses, with disulphate of iron, from ten to twenty grains, extolled by Dr. Balfour, as a certain antidote to erysipelas be infantile or adult, idiopathic.

The *diet* must correspond to this method of treatment, and be given, tolerably freely, in all cases, and Brandy and egg beat up together, form a mixture, at once *stimulating* and *nourishing*, and of the character of nutritious and easily assimilable preparations of our dietetic resources.

Complications, arising from internal inflammation, pleurisy, may be treated in the same way independently; due allowance being made for such inflammation when associated with erysipelas.

LOCAL TREATMENT.—*Warm fomentations*, steeped in a hot decoction of poppy-heads, and continuously applied, will hasten the termination of the disease. Of other appliances, painting with iodine, may be used simply as a protective, instead of as astringents, the compound tincture of iodine and sulphate of iron— ʒi. to a pint of water, are more useful.

Phlegmonous erysipelas presents nothing peculiar pertaining to the subcutaneous cellular tissue, it is invariably although secondarily involves the *early period*, therefore, fulfil a twofold purpose, by Lawrence. By relieving tension, they relieve the skin, and perhaps of the subcellular texture, although extensively. Moreover, pain is thus relieved, and the tension itself moderated by a discharge of blood. Incisions also facilitate the discharge of blood.

Commencing insidiously, a red blush appears, usually at the pubes, which rapidly spreads to the scrotum or vulva, down the thighs and up the abdomen; thus extending without fading on the part first affected. Attended with but little febrile disturbance in the first instance, in the course of two or three days, fever supervenes, and which soon assumes a typhoidal character, with gastro-intestinal symptoms of vomiting and diarrhoea, the little patient speedily sinking into a state of fatal lapse. Meanwhile, the inflammatory affection of the skin and subcuticular texture may have subsided into suppurative formations of matter in various parts of the body; or gangrenous patches are not uncommon. Death takes place generally within a week; although the attack may be prolonged for ten days, or even three weeks. Sometimes pus-forming abscess or peritonitis complicates the disease, and may hasten the inevitable issue. The low vitality of the new-born infant would seem to be a secondary cause of death; for, at a somewhat later period—after only the first month of extra-uterine life—erysipelas is not more dangerous than in adults. And while, in the one case, no *treatment* avails; the other, under the resources of supporting measures, the blood-disease may run its course to recovery.

CHAPTER VII.

PYÆMIA—ICHORRHÆMIA OR SEPTICÆMIA.

The term Pyæmia literally signifies pus in the Blood (*πυον*, pus, *αἷμα*, blood); a *purulent infection* of the blood, and arising, as originally supposed, from the local disease known as suppurative phlebitis or inflammation of the veins; that this infection is, generally, soon followed by the formation of secondary abscesses, or at least by deposits of matter, secondary to the primary disease, and which are distributed in various remote organs and parts of the body. But Pyæmia has more recently acquired a far more comprehensive, or a new, pathological signification, representing also, or instead of purulent infection, two other blood-conditions:—(1) *fibrinous infection*, more commonly, as arising from the integration of fibrinous coagula, or *thrombi*, which had formed within the veins, or arteries, and that the circulation of such matter being arrested in the capillary vessels—a condition known as embolism of these vessels—the fibrinous embolia form metastatic deposits; (2) the blood infection which arises from the absorption of decomposing animal or septic matter, and thence named *ichorrhæmia* or *septicæmia*.

Pyæmia.—*Symptoms, and Diagnosis.*—A wound suddenly ceases to excrete and discharge pus, becoming drier and glazed, or sloughy; the patient is seized with a convulsive *rigor* or shivering, more or less violent, and lasting for a few moments only, or for some minutes; this is accompanied usually with a sensation of cold, and always with great *prostration*; the face looks haggard, vacant, and alarmed, as if the person were conscious of some vital injury, the nervo-muscular system responding with

Similar paroxysms may recur at periods of six hours; or at about the same hours at irregular intervals.

Differing in its symptoms and fit from the inflammatory fever, the attack as described does not fit; but other significant symptoms are present, sometimes a very peculiar odour, like that of hay. But all the *secretions* show signs of elimination from the system, albeit in small quantities, dry, and brown or blackish, while *sordes* collect on the lips. *Rank perspiration*, ammoniacal, of bilious, serous or mucous, and perhaps all these, compete, as it were, incessantly to throw off the only help to complete the exhaustion. The face becomes overcast with a dirty-yellow hue, or becomes overcast with a dirty-yellow conjunctivæ a *jaundiced* appearance; and the patient panitic.

Rapid emaciation soon reduces the patient to a skeleton at about the end of a week or ten days. Some secretion, but in the form of a thin mucus, is still present, the subcutaneous *cellular texture* of different parts of the body is *painful* swellings may be found, or one or more of the knees, elbows, ankles, or hips, are swollen and attacked with acute rheumatism; but looking at the joints in fact, the joints affected are full of pus, these *secondary abscesses* have formed in some of the *organs*, and are announced by symptoms. Thus, with cough, expectoration, and the lungs will probably be the seat of pneumonia, especially on palpation, over the region of the stomach vomiting or purging, that organ may be affected. If symptoms and coma, the brain would not be affected. If any local symptoms and functional disorder is what is discovered after death, is often found to tolerate some.

heat of skin, alternated by sweats, with utter prostration, and the patient sinks.

Pyæmia is not always fatal. Death takes place usually about the third day; sometimes earlier, as the third day; or much later—six or eight weeks. According to the duration of the disease, pyæmia may be divided into *acute* or *chronic*.

Secondary abscesses most frequently occur in the lungs and liver. General characters are these:—In several portions of the organ small granular masses of *consolidation* have taken place, and are of a *purple* or black colour, indurated, brittle, and easily break under slight pressure of the finger. Some of these disintegrated present a yellow spot of pus in the centre of the black mass, in which the pus has altogether supplanted the granular matter and disorganised texture; and these *pus-deposits* are tolerably circumscribed—abscesses are then formed, each surrounded with a dark margin of indurated texture.

Secondary abscesses are usually of a *small size*, in the viscera varying from the size of a pin's head to a walnut, very *numerous*, and of *rapid formation*, sufficient for their development in many organs. Although commonly found in the lungs and liver, other organs and tissues are affected. They occur elsewhere—approaching the following order of frequency—in the spleen, brain, kidneys, heart, skin, mucous membranes, serous and synovial cavities, in the muscles and cellular tissue, and in the prostate.

Diagnosis from primary abscess is twofold. Usually there are no symptoms—no pain, heat, or redness; simply a doughy swelling, or fluctuation—in the subcutaneous cellular texture, or in a joint. It may come to pass that death ensues from coma, asphyxia, or from hæmorrhage—as the result of further blood-poisoning accruing from the non-elimination of various excrementitious matters.

Septicæmia is manifested by essentially the *same symptoms*,—prostration or delirium, with profuse rank perspiration and diarrhœa, all indicate the operation of some blood-poison, and apparently the effort of nature to eliminate it. But according to Billroth's observations on septic poisoning, the initial chills, with increased temperature, are very rare, and they never occur in the course of acute septicæmia; in this disease, the temperature falls to the normal standard, or even below it. The pulse dwindles down to a thread, and in a state of perfect coma, the patient dies in *twenty-four hours*, although life may be prolonged for a week or two. Sometimes the disease runs its course with an abnormally low temperature, especially in enfeebled or aged persons. At death, the *subcutaneous cellular texture* is often found *infiltrated with purulent serum*, or *purulent matter*, accompanied with gangrene of the parts. But the internal organs are free from secondary abscesses, and are congested and softened as in most blood-diseases. Peyer's membrane in the ileum and jejunum may be swollen, when there had been diarrhœa; and perhaps the serous membranes exhibit sero-purulent effusions, as from a low form of pleuritis and pericarditis. The blood, for example, in the cavities of the heart—is in a state of imperfect coagulation, consisting of sily clots, or fluid, like treacle. Decomposition sets in very rapidly.

Thus may be enumerated, exhaustively, and especially from *blood-diseases*, as diseases, as degeneration of the kidneys or exhaustion, increased by the shock from compound fracture or amputation, such predisposing condition. The habit is said to be especially prejudicial, include impure air from overcrowding, the dressing of wounds, defective drainage, the relative influence of heat and cold matter.

(2.) **Exciting.**—*Injuries, Diseases*, as much suppuration, are well known to the phlebitis,—inflammation of veins, or lymphatic vessels. *Suppuration* in compound fracture, caries and necrosis, less frequently; dead bone are apt to provoke osteo-phlebitis, or septic infection. *Diffuse* suppuration is fatal infection, than when pus-formation is confined as in abscess. Thus, diffuse periostitis, suppuration of bone, are specially pyæmic. *Decomposing* animal matter, being then

Prognosis will be more or less *acute* or *chronic* character of the disease, and more rapid the prostration and the more severe, death will be more certain and symptoms is slower and less marked; in some days, and the wound begins to recover, recovery is more hopeful. In septicæmia by similar considerations.

Treatment.—*Preventive* measures of *hygienic precautions*, especially with wounds, free ventilation.

be taken, constitute the only plan of treatment for probably sustaining the patient through the dread exhaustion which must be undergone, even when recovery ensues. Opium has a marked beneficial influence in controlling the rapidity of the pulse, and the general irritability associated with prostration. Creosote seems to have some corrective influence on the putrid intestinal discharges. Scrupulous cleanliness in the dressing of a wound, and free ventilation, must still be observed. *Amputation*, for the removal of the source of infection, will rarely, indeed, succeed in arresting the course of pyæmia.

Secondary abscesses, when tense, and in any superficial or accessible part, may be opened; and by a valvular incision, as in the treatment of chronic abscess, so as not to admit air to the readily decomposing purulent collection; or subjected to free drainage, with antiseptic dressing.

CHAPTER VIII.

HOSPITAL GANGRENE.

Hospital Gangrene is fortunately known to but few Surgeons in civil practice now living; and we must refer to those of the past for information. As expressive of its various characters, and mode of origin, it has received other names: Pulpal Gangrene, Phagedænic Gangrene, Sloughing Phagedæna, Putrid Ulcer, Pourriture des Hôpitaux, Contagious Gangrene, Hospital Sore, and Diphtheria of Wounds.

Signs.—Overlooking the many phases of this gangrene, and regarding only its more constant phenomena, it is, *essentially*, *gangrenous* inflammation. Sometimes the process of destruction resembles more that of *phagedæna*, alternating with rapid *sloughing*; so that the worm-eaten phagedænic surface suddenly becomes a large slough, and then again phagedænic. These different aspects of the disease are apt to mask its really gangrenous character. What, then, are the phenomena more *constantly* observed? Acute pain, sudden engorgement and bloated swelling, dusky-red discolouration around the doomed part, and conversion of its textures into a putrid glutinous or slimy slough, exhaling a peculiar fetid odour. Rapidly extending, all the soft textures are soon melted down, leaving only the bones staring, of an ebony black,—as if the rafters of a house where a fire had raged.

Constitutional Disorder.—Long before any such irreparable injury has been inflicted, the constitutional powers take affront. The period, however, at which the constitution begins to exhibit symptoms of irritation, is extremely irregular, sometimes as early as the *third* or *fourth* day, sometimes as late as the *twentieth*. The countenance assumes an anxious or feverish aspect, the appetite is impaired, thirst succeeds, and the tongue is covered with a white mucus. Some constipation prevails at first, which ends in diarrhœa. The general symptoms have an *inflammatory* or *typhoid* character, according as the causes of either predominate.

be made for space and ventilation, the arrangements of an hospital, or of wounded cases, whether from the *first* case appears in any hospital object is to decompose the poisonous matter, and arrest the progress of gangrene. Such intentions, should therefore be forthwith recommended by Blackadder. Strobel and Welbank. Either of these caustics may be applied until a new, hard, dry, smooth, healthy surface. Bromine, or with the solution was introduced by Dr. M. Goldsmith.

To prevent the *propagation* of the disease, as regards the hands of the dresser, should be daily observed in dressing, and the hands should be kept clean, trivial and healthy. The *bedding*, and the linen furnished, as often as may be necessary, and the accumulation of fomites, the patient will have similar prevention. If neglected, although the disease may be apparently of *epidemic* origin, it will be as in a military hospital, to another local source.

Constitutional treatment must have been of irritation and debility; by the administration of stimulants, with nutritious diet.

itself is often trivial—a mere scratch or graze from a animal in the act of snapping; but the mere application of the o slight a wound, scratch, or other solution of continuity, in surface, is sufficient. In such case, the lick of a rabid dog es hydrophobia. The surety of inoculation will obviously the number of wounds inflicted, by lodgment of the virus hæmorrhage, and, above all, by unobstructed inoculation naked flesh as compared with the protection offered by

ATTACK, AND LOCAL SIGNS.—Hydrophobia ensues in a averaging about *six weeks*, from the date of the reception The wound has generally healed, or it may not have healed

In either case, slight pain of a rheumatic character shoots the bitten part to some distance; so that if the hand be fected, the pain extends up the arm and shoulder, fixing pezius muscle probably, or the proximate side of the neck. ingling heat, or even a sensation of cold, is experienced, n; but either sensation equally *extends*,—say, up the arm

Meanwhile the cicatrix swells, reopens, and discharges tter. Occasionally no local symptoms occur; neither the ating pain, nor any inflammatory condition of the cicatrix.

General Disorder.—After the lapse of some days perhaps, other lable, because constitutional, disorder begins. The nervous r with its ally, the muscular, are the subject of all those ich characterize this affection. The *cerebro-spinal axis* susceptibility. The symptoms are those of *cerebral excite-essive general sensibility*, and *spasmodic affection* of the d in deglutition and respiration, ending in convulsions of

. An overwhelming dread takes possession of the poor nights are sleepless or broken by starting dreams,—this t on delirium; a dull heavy pain caps the head and mples, light is intolerable, and the slightest noise jars the ains occur in various parts of the body, and a feeling of ut the throat, with a *difficulty* in *swallowing*, especially distressing hiccupy catch in the breathing, sighing or ie course of from four to six days, possibly only a day or emarkable symptom of true hydrophobia supervenes,—an *read of fluids*; any attempt to drink—even the sight or ; the thought of it, or anything associated therewith, as eacups, or of a pump—excites a convulsive paroxysm, ffection. From the commencement of the disease, the es to 105° or 106° F.

ive attacks are *paroxysmal*, with *complete* intermissions. accumulating in the mouth occasions an *incessant action* w to extricate it. The pains now piercing the epigastric regions, more particularly, the general sensibility becoming e acute, and the convulsive paroxysms more frequent, rtracted, soon exhaust the patient's bodily power, while rried on to *furious mania*; and thus, when fighting for rly worn out, the sufferer expires. The second or third ngs this happy release. It may be postponed to the fifth

TREATMENT.—Human beings
Of persons bitten by dogs, when
doubtful, not more than 3 to 5
hydrophobia—as *distinguished* from
orders. Pasteur's record of *preven*
latest offering of Science to Phil
of all these facts. During the
experience—thirty-six years, there
in the Royal Free Hospital! Pro
is the most effectual *preventative*.
impracticable, *free cauterization* ma
cautery, or with strong nitric acid,
is impossible to say how late, in th
would prove successful; for, if not
hydrophobia might not supervene.

Prevention of Propagation.—Thes
should at once, if possible, be inqui
concern us in this country. Rarely i
popular notion of a "mad" dog. No
tendency to bite, and certainly no d
human subject. Rather will suspic
the animal evinces only some strange
manner. In very many instances th
up straw, bits of paper, rag, thread, o
animal laps water greedily. A dispos
and particularly to lick anything co
another dog; great aversion, however
to the latter, is very commonly obser
unusual propensity is soon followe
The animal snaps at those about it, i
voked, or vents its rage in peculiar
husky and jerking.

ability to bite. Thus, observes Fleming, in *dumb-madness*, the lower jaw is paralyzed and drops, leaving the mouth open, and showing the tongue flaccid or swollen, covered with a brownish matter, and a glutinous, stringy saliva lying between it and the lower lip, and coating the fauces, which sometimes appear inflamed. Slavering is almost peculiar to this form of rabies, but the animal is ordinarily helpless and not aggressive; it can neither bark nor bite, nor eat nor drink. In *tranquil rabies*, the dog lies rolled up, as if comatose, and indifferent to everything; it cannot be provoked to bite, and dies quietly in about fifteen days from the commencement of these symptoms of the disease.

Supposing a healthy dog to have been bitten by another dog, decidedly rabid. The latter will, of course, be killed; but when may the former apparently *healthy dog* be allowed to go free?

The question turns on the period of latency among animals. In the dog it is considered to terminate about the end of the *sixth week*.

The *communicability* of hydrophobia or rabies among animals and man is another question relating to its propagation. The bite of a rabid dog will communicate the disease to another dog. Even dried saliva on the earth, from the slavering of a *muzzled* dog, when rabid, will induce rabies in a healthy dog which has licked the contaminated material. But the communicability of this disease depends on the inherent capability of the animal affected to *engender* it spontaneously; failing which, he may bite in vain. The dog can generate rabies, and therefore communicate it to another animal, or to man, in the shape of hydrophobia. Sheep, horses—the herbivora—and man cannot generate the disease, and therefore cannot communicate it. Thus, rabies in a flock of sheep, consequent on the bite of a rabid dog, is not communicated from a sheep to another, although the sound are often bitten by the diseased, and in parts stripped of wool. (Dupuy.) By the experiments of Vaughan and Babington, animals were inoculated with the saliva of hydrophobic patients, but without any effect.

Curative treatment will be utterly useless, although it may be possible to palliate symptoms and prolong life. Chloroform has often given relief. Trite of amyl, administered by inhalation, relieved the spasms in one case; and Dr. Watson, of Jersey City, found the hypodermic injection of opium most beneficial; a sixteenth, a ninth, and a sixth of a grain, were injected at intervals, the symptoms subsided, and recovery ensued. The application of an ice-bag along the whole length of the spine seems to exert some influence in allaying the excitability of the cord; while stimulants and nourishment support the patient in the exhaustion consequent on the convulsive paroxysms.

Snake-Bites.—The viper, occasionally found in England, the rattlesnake, the cobra di capello, the whip-cord snake, the phoorsa-snake, the acco-pipe snake, and the puff-adder, of Eastern countries, are the venomous Snakes.

Local Condition.—A *piercing pain* is immediately felt, rapidly shooting through the limb; swelling quickly succeeds, and a *mottled lividness*, indicating that the skin is now involved. The cellular texture of the whole limb, and perhaps down the proximate side of the trunk, becomes gorged with a bloody sanious fluid; presenting an extensively *fused swelling*, with phlyctenæ here and there. Very shortly the pain

sufferer expires.

TREATMENT.—If we assume the hour, preventive measures should be taken. The poison may be removed from the wound by the general circulation, or neutralized by a glass is calculated to withdraw the poison by a ligature above the part affected, and the actual cautery included, the third method, *cupping* is the most effectual. Discharge of the introduction of the poison, must be avoided.

Curative treatment has very little effect. A condition of utter prostration or ammonia, must be freely administered. It has been recommended as a specific. An Indian remedy. But its efficacy is doubtful.

Insect-Stings comprise the poison introduced by a variety of insects; bees, wasps, spiders, the scorpion, tarantula.

The local symptoms of irritation induced, are seldom severe and soon subside. They may assume a dangerous or even fatal character in a low state of health; the sting being followed by inflammation of the part, or death.

TREATMENT.—The local irritation may be removed by cold, or slightly stimulant lotions; or by a solution of acetate of ammonia. It is apparently by neutralizing the formic acid on the surface, by means of flour, chalk, or lime. Usually, however, any inconvenience is removed by the application of a phlegm.

anatomy. But absorption may occur through the skin, without any lesion whatever, when the part is long *soaked* in a septic fluid during post-mortem work.

Symptoms.—The effects, local and constitutional, are always the same; differing only in degree, according to the virulence of the poison introduced, and the previous state of health; thus giving rise to the mild and the acute forms of the infection. In both, there is some local irritation or mild inflammation, advancing perhaps to *pustular* suppuration, with inflammation of the *lymphatics*; and attended with febrile disturbance, of *typhoid* character, resembling *pyæmic* infection.

But, in the *mild* form of the disease, the puncture becomes surrounded with a red areola, a pustule arises, and bursting, discharges an unhealthy pus, while tender rose-coloured lines—the inflamed lymphatics—spread branching up the limb, and the axillary glands become enlarged and perhaps suppurate. Low febrile disturbance, with loss of appetite and diarrhoea, accompany these local symptoms, reducing the patient to a cachectic condition, but which pass off in a slow recovery.

In the *acute* form of the disease, the constitutional symptoms seem almost to precede, and they certainly exceed, the local at the seat of puncture. In twelve or twenty-four hours after inoculation, by a slight prick, or scratch with the hooks, in dissecting, a severe *rigor*—the *pyæmic* shudder—occurs, with great nervous depression, a rapid pulse, and marked anxiety of countenance. This seizure is accompanied with the formation of a small, perhaps insignificant, vesicle or pustule, containing a thin, milky or puriform matter, and having an inflamed areola; a *sharp, stabbing pain*, fixed in the *shoulder*, and shooting down the chest, announces the commencement of suppuration in the axillary glands, and some red lines connect this purulent *dépôt* with the puncture-pustule. In a few days, diffuse inflammation of the arm and forearm presents considerable *œdema* of the limb; and diffuse *suppuration* may extend rapidly from the armpit into the sub-scapular and sub-pectoral regions, or down the side, involving the subcutaneous cellular texture in a *sloughy mass*, without much discolouration of the skin. The constitutional disorder becomes more *typhoid*, and low delirium or coma supervening, death ensues in two or three weeks. Or, abscesses continuing to form, the patient, in a hectic state, at length sinks from exhaustion. Recovery may, indeed, occur, leaving him the wreck of his former self.

Conditions of the dead body most infective.—Putridity must not be supposed to signify an infective state of the body; the less advanced in decomposition, the greater the risk, not unfrequently, from the inoculation of the animal matter, and a *fresh subject* is often the most dangerous. The bodies of persons who have died in certain diseases are specially infectious; notably in *blood-diseases* which were attended with diffuse inflammation, of which erysipelas is the type, and particularly puerperal peritonitis. Dead matter resulting from mortification, as a small spiculum of necrosed bone soaked with pus, may prove equally noxious.

TREATMENT.—*Local* measures consist in the prompt removal or destruction of the animal matter introduced. Any bleeding should be encouraged, thus to cleanse the wound; as by steeping the part in lukewarm water, or by exposing it to a stream of water. But the wound had better be *well sucked*, and then cauterized by a firm touch with *nitrate of silver*.

Malignant Pustule, or Charbon
tagion, the poisonous matter being contained in the pus, and remains; for the disease is not propagated from one individual to another.

Local Condition.—Soon after any morbid matter, a stinging sensation is experienced, and the skin is hardly elevated above the skin. Then it becomes a *blackish vesicle*, which speedily runs into an *edematous swelling*, having a *violet tinge* in the directions. Occasionally, neither vesicle nor swelling occurs. (W. Lawrence.) Should several pustules appear, the disease is especially more perilous, and especially if situated near the brain. Malignant pustule is attended with a considerable congestion of the brain. Malignant pustule has a peculiar appearance, but differs from it in being attended with a considerable swelling. And this etiological consideration will also apply to the carbuncle. The bacilli of carbuncle are found in the corium and hair follicles.

Constitutional Disorder.—A variable period of incubation precedes constitutional symptoms supervene. Fever, depression of the stomach, and vomiting, is soon succeeded by a general prostration, the termination of septicæmia. In this case, the disease ensues.

The nature of the morbid matter itself is not known. In beasts affected with "contagious carbuncle," the disease is imparted by any accidental inoculation, in the case of man, by the bite of a live animal, or during the manufacture of hides, which is consequently most rife among butchers, tanners, and sorters. It may also be produced by eating of diseased meat. Temperature and moisture have much to do with the disease, the disease is most prevalent in damp localities and in cold weather. The morbid matter—whatever it is, retains its power for a long time. Billroth alludes to the fact that the matter of malignant pustule in man sometimes remains for years, and other animals.

DISEASES OF THE NERVOUS SYSTEM.

CHAPTER X.

SHOCK OF INJURY.—COLLAPSE.

Symptoms.—Failure of the heart's action, or *cardiac syncope*, is the immediate effect of any sudden and violent impression on the nervous system. This failure of function is denoted by a thready, feeble, slow, and afterwards frequent and perhaps irregular, pulse; which is accompanied with pallidity, a cold clammy skin, with a reduction of temperature averaging one or two degrees, a haggard look, and lack-lustre eye, great muscular prostration, soft sighing respiration, and, perhaps, some cerebral disturbance; symptoms which constitute the state known as Shock, or Collapse as arising from Injury. Other symptoms are exceptional and occasional only. Hiccup, vomiting, relaxation of the sphincters, attended with involuntary micturition and defæcation; suppression of urine, convulsions, and stupor.

Causes.—*Injuries* of all kind—*e.g.* incised and lacerated Wounds, Burns, Fractures, and Dislocations—are attended with Shock. The *part* injured has an important relation to Shock. Head-injuries, affecting or involving the brain, are attended with more disturbance of the cerebral functions; while injury to the peripheral nervous expansion suspends the reflex functions more particularly. Thus, a stunning blow or fall on the head may cause a more intense shock, apparently; but a crushed limb, with far less cerebral disturbance, may be a more fatal injury.

Simple shock, without any apparent structural damage, may be equally deadly. A blow, for example, over the epigastrium; or pain, intense and prolonged; a stroke of lightning or exposure to cold. *Certain poisons*, probably, have an action resembling Shock; such are powerful sedatives, as tobacco, and powerful purgatives. *Mental emotion* may operate in like manner. Fear, or bad news, will cause the heart to sink in a moment, accompanied with the pallor of collapse; while a depressing passion, such as grief, weighs it down more permanently.

Predisposing conditions are very influential. Thus, Shock may be easily occasioned, yet soon pass off, as in *youth*; or not so readily occasioned, and yet persistent, as in *old age*. *Premature age*, by intemperance or sexual excess, is peculiarly unfavourable. *Prior disease* of vital organs, *e.g.* the heart, may unquestionably render the individual more susceptible to shock from injury. *Constitutional susceptibility* is well marked in the shock of some individuals.

...the heart is found engorged and distended, especially the right auricle. The lungs, generally, is similarly distended. Coagulation is to some extent, but imperfectly; a considerable quantity of fluid, while the clots are loose and altogether fluid. *Rigor mortis* commences strongly. A significant fact is the absence of food which may have been taken, and no change; thus indicating the suspension of all other functions.

(2.) *Reaction*.—A natural restorative period varying from a few minutes to two hours or more. This reaction, as it is termed, of all the functions which have been temporarily suspended. When circulation is regained, the pulse acquires its frequency and irregularity. With the temperature rising two degrees, or more, and the colour of the living body reappears perceptible, prostration is less marked.

Inflammatory Traumatic Delirium.—Is denoted by a rapid bounding pulse, but is not hot and the face flushed. The breathing is much restless tossing about, and perhaps associated with great debility, and the mind becomes at length frenzy, possibly, subsiding in coma. A clammy sweat, ends in death; or ultimately regains its force, loses its frequency, and is re-established.

Nervous Traumatic Delirium is similar to the latter disorder occurs in persons of nervous temperament. The symptoms are those of *exhaustion* rather than of *inflammation*. The pulse is weak, rapid, and compressible, there is no sweat, and the tongue trembling, and cold and dry, brown appearance, and the patient is in a state of *delirium*: all the functions are suspended.

anxiety of countenance. Sleeplessness, with tremors, in a person of intemperate habits, portends an attack of this nervous delirium after injury; and which may soon be fatal—death taking place in a few hours or days, from cerebral effusion and *coma*, or from *rapid exhaustion*.

The *prognosis* of shock is always precarious and uncertain. It will depend very much on the causes, immediate and predisposing, already mentioned. *Persistent* conditions of bodily injury are unfavourable. The *extent* of an injury indicates rather the immediate intensity of shock, than the probability of its continuance, under treatment. A certain *fall and rise of temperature* may be taken as a sure ground of unfavourable or of favourable prognosis; the less the decline, the more favourable, and a fall below 97° is proportionately a more fatal omen; while a rise of temperature to 100° or 102° , during reaction, not later than the second day, is a salutary indication, a stationary temperature below 100° being equally unfavourable; but a higher elevation to 105° or 106° is an almost surely fatal sign. After *surgical operations*, as a general rule, if *recovery* ensues, the temperature falls about half a degree; the maximum temperature of about 102° is reached in from twenty-four to forty-eight hours, and then there is a descent, gradual and steady, until the normal standard is regained, and which is maintained. In *fatal* cases, no fall of temperature takes place, as in cases of recovery.

Treatment.—The patient should be placed in the recumbent position, and *stimulants* administered to further aid the returning circulation. Warm tea for children, brandy or ammonia and water for adults, may be given, provided the patient can swallow; otherwise, during insensibility, any fluid is liable to pass into the larynx and cause suffocation. Then also, a stimulating enema, of turpentine for example, will be an advantageous mode of stimulation. In all cases, warm *blankets*, *hot bottles* to the feet and epigastrium, and perhaps galvanism, are available and effectual resources. In apparently *hopeless* cases, artificial respiration, patiently continued, may be resorted to with success.

Excessive reaction must be met by opiates rather than blood-letting; the fever being nervous more than inflammatory. The substitution of light nourishing food for mere stimulants, will be found advantageous; for there is still a strange mixture of exhaustion with *such* reaction.

Traumatic Delirium requires similar treatment. The quantity of *opium* borne with impunity, and eventually proving remedial, by inducing sleep, is often surprising. Grain doses of solid opium, or equivalent doses of the tincture, may be administered repeatedly, at intervals, according to the degree of excitement, with *stimulants*, in kind and quantities, according to the prostration or exhaustion, and the previous habits of the individual. The hypodermic injection of morphia is often a more certain and speedy method of administering a narcotic, without any aggravation of the dyspeptic and hepatic symptoms which are commonly present. Chloral, in doses of from grs. xx. to ʒss. , may be substituted for opium, but its action is less certain. *Nourishing food* should, as soon as possible, assist or supersede these more immediate resources. The restraint of a strait-waistcoat may become necessary to prevent the patient interfering with the dressings or apparatus at the wounded part; but the increased tendency to cerebral effusion which is provoked by such resistance must not be overlooked. An ice-bag to the head will then be advisable.

The question as to the performance of a *Surgical operation during Shock*, is determined by two considerations:—the persistence of any causative condition, as, for example, a bad compound fracture; and, secondly, the pathological fact, that the nervous system and circulation *already* in the state of Shock, is less susceptible of further shock than after reaction. An almost *immediate* surgical operation thus forms part of, and joins issue with, the injury for which it is performed. *After* that period of juncture, it is better to make a compromise with the vital powers, by waiting for *incomplete* reaction.

Chloroform is detrimental, in proportion as Shock prevails, and equally useless, owing to the comparative insensibility of the patient.

CHAPTER XI.

TETANUS.

Tetanus (*τετῶν*, I stretch) signifies a violent and involuntary contraction of the voluntary muscles, attended with severe *pain* and *rigidity*.

Symptoms, and Diagnosis.—The spasmodic contractions having commenced, never entirely relax throughout the course of the disease; they are *tonic*, thus distinguishing them from intermittent or *clonic* spasms in ordinary convulsions, as in hysteria or apoplexy; and complete *consciousness* is retained to the last, this additional peculiarity distinguishing the tetanic from clonic spasms in epileptic convulsions, and from those of hydrophobia.

Tetanus approaches and proceeds by the following series of spasmodic contractions, each continuing in the order of their succession. The person about to suffer, has felt weak and low-spirited for two or three days, or the disease emerges from the constitutional disturbance of Shock; then—in either case—*stiffness* is first experienced about the *root* of the *tongue*, which is usually *retracted*. Articulation therefore is imperfect. This is accompanied with a sense of *painful rigidity* in the *posterior muscles* of the *neck*, and some difficulty in moving the jaw. The patient complains only, perhaps, of having a sore-throat, and a stiff neck. But the jaw soon becomes fixed, gradually, or sets with a sudden snap. The teeth are firmly and closely clenched. If tetanus proceeds no further, it is known by the name of *trismus*, or “locked-jaw.” Generally speaking, other sets of muscles become involved. The facial muscles are affected; the angles of the mouth being drawn up, a peculiar expression is presented, the “tetanic grin”—*risus sardonicus*. The features have a hard and fixed aspect, or are occasionally distorted with convulsive twitchings; and there is an appealing expression of painful anxiety. Coupled with this, there is sometimes an aged look, a young man of twenty looking perhaps sixty years of age. *Deglutition* is accomplished with great difficulty, and fluids are convulsively ejected when any attempt is made to swallow them. In this particular, tetanus resembles hydrophobia. Even the sight of fluids may occasion dread,—another point of resemblance.

Yet in no other respect is there any similarity between these diseases. The saliva, not being readily swallowed, becomes viscid and frothy, and clogs the mouth, to overflowing; but there is no foaming at the mouth of a thick tenacious mucus, secreted from the fauces, with constant movement of the jaw to extricate it, as in hydrophobia. Other peculiarities supervene. Pain strikes through the body from the ensiform cartilage backwards to the spine, and being accompanied with intense *spasm* of the *diaphragm*, occasions agonizing dyspnoea, which has been compared to that of hydrophobia. Very soon the *muscles* of the *back* contract, and with such violence that the body is drawn into a form of an arch resting on the head and buttocks (opisthotonos); or the abdominal muscles contracting, become as hard as a table, and draw the body forward (emprosthotonos). During these spasms, the rectus muscle has been torn with the violence of its contractions. The body is sometimes bent to one side (pleurosthotonos); but I have never yet seen this distortion. Next in order, the muscles of the *lower extremities* are involved; and lastly, those of the *upper*, excepting the fingers, which generally remain movable to the last. During *sleep*,—if perchance the patient dozes for a few minutes,—the muscles become relaxed; the rigid tension returning immediately on waking.

The symptoms of Tetanus constitute one continued manifestation of *spinal excito-motion*, without suspension of the cerebral functions; but the spasms—violent and continuous—provoke general disturbance of the *organic* functions. Thus, the respiration being much embarrassed, the heart beats more quickly and forcibly, giving to the pulse similar characters; but they are eventually succeeded by feebleness and irregularity. The temperature often rises, and in a marked degree as death approaches; but there is no true inflammatory fever, from first to last. The urine is perhaps scanty and high coloured, and is sometimes retained or voided in small quantities, while the skin pours forth abundantly a sour-smelling sweat. Lastly, obstinate constipation is a constant and significant symptom throughout this disease; and should an evacuation occur, it is singularly offensive.

The *Diagnosis* of tetanus is not always clear. I have already noticed how it differs from hydrophobia, epilepsy, apoplexy, and hysteria. But it may resemble the latter disease. *Hysteria* with spasm—Hysterical tetanus—occurs sometimes in females, and presents a wonderful likeness. No fatal case is recorded. In females, trismus or subacute tetanus may assume an hysterical character, or hysterical symptoms may be associated with the tetanic, the disease being really tetanus and occasioned by any injury. Certain *drugs* produce spasms, resembling those of tetanus. *Strychnia* is thus specially deceptive. But the tetanic spasms induced by strychnia are remittent or intermittent, there is no locked-jaw, and they subside entirely as the poisonous influence passes off, or kill in the first onset if the dose or doses be sufficiently potent. *Morphia* sometimes produces convulsions, but they are epileptiform, and long in their development.

Certain *varieties* may be noticed. *Spasms* *primarily* *attacking* *the* *muscles* *of* *the* *part* *injured*, instead of the muscles of the jaw. Occasionally, the spasms are *unilateral*,—on the side of injury, instead of having their usual symmetrical character. *Absence of pain* was character-

not epileptiform, may occur. Most of the seventy-two, in Guy's Hospital, gathered. *Remission of the symptoms* noticed in several instances. In one subsided for twenty-eight days, and cold.

All these anomalous forms of tetanus on the, possibly obscure, diagnosis of

Pathology.—(1.) *Structural changes.*—No deposit nor any appreciable alteration in the walls of the blood-vessels of the cord, *dilated* at short intervals, and surrounding their diameter, by *granular* and *other* changes, which, the *nerve-tissue*, to a greater or less extent, undergo. In the first stage, *softening* of the tissue, *disintegration*, the tissue becoming soft and transparent. Ultimately, the reduction of the blood-vessels also share in the disintegration with the ensheathing granular exudation. *Disintegration* of structure has taken place in *size*, may occur at a *single spot*, and extend at *several spots*, which advancing, coalesce into a *tissue*, or portions separating, are left as

This process of destruction affects perhaps its *central* part. Other portions similarly affected, in some degree; the *oblongata*, pons, corpora quadrigemina, and convolutions of the brain, being the seat of the exudation, and disintegration of the nerve

(2.) *Peripheral Nerve-changes.*—The disease, or inflammation of some nerve connected with that has occasioned the disease; the inflammation, often extending up the neurilemma

It would therefore appear that

Persistent irritation of the *peripheral nerves*, by which the exalted excitability of the cord was induced.

The causative relation of peripheric irritation to traumatic tetanus is indicated by two general facts:—that commonly, the muscles near the wound are first attacked, or most affected, with spasms; and that any irritation of the wound, or the cicatrix, will sometimes excite, or aggravate, the spasms. To this pathological evidence may be added the fact that section of the irritated nerve or nerves, has sometimes cured tetanus.

In so-called *idiopathic* tetanus, arising from exposure to cold and damp, it is probable that the morbid condition of the blood-vessels of the cord results from changes in the state of the peripheral nerves, which may act through reflex action or otherwise.

Associated with these essential changes of structural condition in tetanus, others, which are apparently incidental, may be noticed. In cases of some days' duration, a development of young connective tissue takes place in the spinal cord; as if tetanus had resulted from inflammation of the cord,—spinal myelitis. Or, a marked vascularity of the membranes of the cord, with effusion of serum, may be found, and engorgement of the veins within the vertebral canal. Sometimes, these changes have extended to the brain, but in a less degree.

Causes.—(1.) *Injuries of all kinds* may possibly be followed by tetanus. From the most trifling scratch to the most terrible laceration, tetanus is liable to ensue, yet not with equal probability. But it arises most frequently from those injuries which, in point of their *extent* or *persistence*, by continued nervous irritation, are most conducive to the continuance of Shock. Burns are thus peculiarly liable to induce tetanus. Punctured, lacerated, and contused wounds, particularly in the hand or thumb, of the sole of the foot or of the toes, have a direct tetanic tendency. Unyielding fibrous textures are peculiarly revengeful in this respect; yet the mere division of a fibrous texture is innocuous, as shown by the safety of tenotomy. Compound fractures and dislocations, rather than the simple form of these lesions, are threatening complications; and more so, if the fracture be oblique and playful among nerves and muscles, or if the dislocation be that of a ginglymoid joint, as the thumb. Gunshot wounds, involving possibly other forms of injury, rank high as causes. Amputation, as in the thigh, or the removal of a breast or testicle, are known causes. So also minor operations; *e.g.*, for fistula in ano, ligature of piles, extraction of a tooth, cupping, the irritation of a seton. *Diseases; e.g.*, gangrene, ulcer of the leg, a guinea-worm under the integument, ulcers of the tibia. In obstetric practice; *e.g.*, abortion, retained placenta.

The condition of a wound, at the time of tetanus, seems to have little relation to the disease. The absence of inflammation, or of any indisposition to heal, is remarkable.

Period of probation or incubation, between the local injury and the commencement of tetanus.—The average time is the *tenth day*. As extremes may be mentioned a few hours, or some days,—the fifth to the fifteenth day, and up to the twenty-second day, or even at the tenth week.

Tetanus arising from any of the foregoing forms of Injury is denominated *traumatic*; as distinguished from tetanus arising from other causes, whether external or internal, unconnected with injury, the disease being then named *idiopathic*.

also near the sea-coast t
Terminations.—(1.) General
the *second* or *third* day, as *acute*
chronic tetanus. But the former
so. *Traumatic* tetanus is more st
The *earlier*, however, the symptom
attack. The *mode* of death is, usual
the muscles of the larynx; which,
produce almost instant suffocation.
swallow, seems to excite this issu
frequent, mode of death.

(2.) *Recovery* is preceded by a gra
tractions; and this is generally the
tenth day. But the *longer* the period
ment of tetanus, the *more chronic* is
the probability of *recovery*. Converse
tion, as well as the more rapid the prog
fatal will be the issue.

Prognosis.—The prognosis of tetan
sideration of the conditions which chi
fatal issue, or to recovery. They are, l
pathic origin of the disease, the influenc
its speedy accession, and its acute or chr

Treatment.—*Preventive measures*
resources. This implies the early detecti
causes in operation; such treatment nece
causes, rather than to constitutional c
detection or are beyond control. Hence
frequently in tetanus of *traumatic* origin.
bation is available for surgical interferenc
cleansed of foreign bodies, and the part
fracture

sixth of a grain for a dose, may be thus employed. Repeating the dose every two or three hours, until contraction of the pupil is induced, wine and liquid nutriment must be freely given—principally per rectum; in order thus to support the patient's strength under the depressing influence of this powerful agent, and in the rapid exhaustion from the tetanic paroxysms. Chloroform may relax the spasms, for a while, and thus relieve pain.

Removal of the exciting cause of tetanus may sometimes prove curative. Thus, an injured or irritated nerve has been divided, with successful results. But this operative procedure must be resorted to at a sufficiently early period—before the spinal cord has become so affected, that the tetanic spasms are established; and the section must be high up—above the affected portion of nerve. To ensure the latter provision, Dr. Brown-Séquard suggests that a little bit of the nerve should be excised, and examined to determine whether it be inflamed, in which case the trunk must be severed higher up, as near the nervous centre as may be safe. Instead of dividing many nerves, amputation of the limb will be preferable,—provided it be done in time.

In *chronic* tetanus, although any one or more of these "remedial" measures may fail to control the disease, yet the chance of recovery will much depend on the free administration of nourishment and stimulants. Liquid food, such as strong beef-tea, eggs, wine and brandy, or when deglutition becomes more difficult, nutritive enemata, may thus avert the tendency to death from exhaustion; while the patient should be kept in complete quietude, and at a uniform temperature, any exposure to a draught of cold air being sometimes sufficient to provoke the tetanic spasms.

Delirium Tremens, and Hysteria.—See Author's "SURGERY—SCIENCE AND PRACTICE."

SPECIAL PATHOLOGY AND SURGERY.

DIVISION I.

INJURIES AND DISEASES OF TEXTURES.

SKIN AND SUBJACENT TEXTURES.

CHAPTER XII.

WOUNDS:—INCISED WOUND. WOUNDS OF ARTERIES AND VEINS.

A *Wound* is a solution or breach of continuity of the soft tissues, suddenly produced, in any part of the body, and by some direct external mechanical cause. Such lesion may be effected by various instruments of a cutting, tearing, or puncturing character. Hence, Wounds are commonly distinguished as Incised, Contused and Lacerated, and Punctured. Gunshot Wounds are also contused and lacerated. Poisoned Wound is characterized, not by the nature, and still less by the extent, of the lesion itself, which may be only a slight puncture; but, by the accompanying introduction of some poisonous matter, whereby the constitutional disturbance becomes of far greater consequence than the local lesion.

Incised wound has a natural tendency to undergo repair, or to heal, by primary adhesion, when its surfaces are placed in contact; all other wounds, in proportion as they are contused or lacerated, have a natural tendency to sloughing, and then to undergo repair by the slower process, on an open surface, of suppurative granulation and cicatrization.

INCISED WOUND.

An *incised* wound is a solution of continuity of the soft textures; it is produced, and with even division of the tissues. The former distinguishes this lesion from a breach resulting from ulcer—the latter character defines it from a contused wound.

oms.—Pain, of a burning or smarting kind, and hæmorrhage of blood, in various degrees, accompany the division of nerves and vessels; and the wound opens or gapes more or less, according to the elasticity, muscular contractility, and weight of the parts. The symptoms are not peculiar to this, or any other kind of Injury; but of the latter condition, gaping of the wound, is the negative of a *subcutaneous* incised wound. This lesion is, moreover, owing to the action of the air; a peculiarity of essential importance, influencing the course of a subcutaneous wound in respect to its more rational treatment.

An incised wound is produced by the edge of any sharp cutting instrument, as a knife, chisel, or sword; not by a blunt or a pointed

instrument. It produces constitutional disturbance in proportion to the division of nerves and blood-vessels, and to the functional importance of the parts in the system. Hence, the *Shock* of injury to the nervous system, the *Collapse* arising from profuse or persistent hæmorrhage; and the *functional disturbance* arising from wound of an internal organ, as the lung or intestine.

TRAUMATIC or SURGICAL FEVER is simply that form of inflammatory fever which arises from a wound of any kind, or a surgical operation, if the injury be of sufficient magnitude, as a compound fracture or an amputation, thus to induce this constitutional disturbance. Like ordinary pyrexia, the traumatic variety is essentially a blood-infection, arising from the absorption of materials at the seat of inflammation. Traumatic fever, of traumatic origin, begins usually within a few hours after the injury or operation, and is then associated with the shock, or not until the second day or later; and it may continue a few hours, or continue from two to seven days. In the wound-fever, the pulse and the temperature are generally increased, the one increasing in frequency as the other rises, and as it falls. The maximum temperature averages 104.9° .

But the *degree* of febrility does not depend on the magnitude of the injury or operation, nor on the part affected. Nor, again, does it depend, even to a considerable amount, seem to have any influence, on the rise of temperature. On the first day, a high degree of fever affords no indication that the fever will be of long duration; its continuance is not influenced by primary union of the wound, or, finally, by the age and constitution of the patient. Lastly, the degree of fever does not determine the period of febrility. The febrile reaction may return, from some cause of irritation in the wound, the division of an adjoining part, or from the supervention of some complication, as erysipelas, pyæmia, or tetanus.

HEALING.—Incised wound tends to undergo the reparative process by primary adhesion, *unaccompanied* by inflammation; when the edges of the wound are in contact. But an incised wound may heal by other modes of repair, under different circumstances. It will be necessary to here describe all these modes of healing, which are three in number; although the latter two will be found to pertain essentially to Contused and Lacerated, or open, Wounds.

OF REPARATION.—First. IMMEDIATE UNION, without any inter-

vening substance, such as blood or lymph. (Union by the first intention, and through the medium of fibrin of blood extravasated—Hunter.)

Secondly. PRIMARY UNION, by Adhesion.—Union by the medium of coagulable lymph, or a clot of blood—mediate by lymph or blood. (Union by adhesion, or adhesive inflammation—Hunter.)

Thirdly. Reparation by SUPPURATIVE GRANULATIONS and CICATRIZATION.

Secondary adhesion, or the union of opposed granulations.

Fourthly. Healing under a SCAB.

(1.) IMMEDIATE UNION. This is *very rare*. Incised wounds may thus unite when the cut surfaces are immediately replaced in close contact, so that no substance of any kind intervenes. The blood itself is pressed out of the wound, the divided blood-vessels and nerves are brought into perfect contact, and reunion ensues by the opposed surfaces simply *growing together*. Repair is very speedy. It will take place in two or three days; possibly in almost as few hours. No intermediate substance exists in a wound thus healed; consequently no cicatrix or mark remains.

(2.) PRIMARY UNION.—A period of reparative inactivity, perhaps of short duration, succeeds the injury; during which the divided textures are indisposed to unite, although placed in apposition. But this condition of apparent inactivity may partly be due to the presence of some foreign body between the cut surfaces, or from continued hæmorrhage. The process begins whenever the textures are *glazed over*—in a few hours,—thus sealing the blood-vessels. This appearance of a wound denotes either the previous exudation of reparative lymph, or the coagulation of a thin layer of blood, just sufficient for adhesion. The lymph becomes organized, in the form of *fibro-cellular* or *connective tissue*, constituting the bond of union; blood may undergo this change, but its presence probably retards the healing process. Union may be completed in a few days, or possibly under twenty-four hours.

New *capillary blood-vessels* shoot through the connective tissue; they are formed also in coagulated lymph, and occasionally in blood-clot, as reparative materials. Reproduction of the original texture is a rare event. Skin, with its papillæ and cuticle, muscle, tendon, artery, cartilage, and bone, in the first stage of fracture-union, are severally represented by fibro-cellular tissue, more or less vascular. Nerve is repaired by means of connective tissue, and also by the formation of new nerve-fibres, which running through this tissue, become connected with those in the nerve above and below, thus reinstating its continuity. The grey matter of nerve centres would not appear to be reproducible.

Inflammation may, and often does, attend the process of primary adhesion; the healing is effected by what John Hunter named “adhesive inflammation.” The divided capillary vessels, immediately adjoining the lips of the wound, soon become plugged with coagulated blood; whereby the collateral circulation is proportionately increased. *Cells*, identical with the pale corpuscles of the blood, or with lymph-cells, are soon produced in abundance—by emigration within the interstices of the connective tissue immediately adjoining the wound. The inflammatory cellular infiltration is developed into connective tissue, and intercellular substance is deposited, which consolidates the newly formed tissue. This interstitial substance is most probably *fibrin*; produced, as Billroth

exudation from the capillary vessels, under the influence of blood-cells. Schmidt's experiments point to the con-fibrogenous substance is deposited, which, by combining with the elastic substance of the blood and tissues, forms coagulated fibrin. Sersers maintains that this so-called interstitial fibrin is not a new tissue itself, in a transformed state.

Appearances which accompany, and as *signs* denote, this process, are as follows:—In the course of twenty-four hours, the incised wound becomes red, and slightly swollen or puffed up, and hotter than the adjoining integument; but this inflammation is restricted to the margins of the wound, in a line reaching its height by the second or third day, the inflammation passes off by the fourth or fifth day, leaving the wound at the end of a week. The cicatrix, however, appears as a white line; but it slowly assumes a paler tint, and softer character; it changes into a white and somewhat depressed line in the middle, though this mark remains permanently, being visible to the naked eye with the aid of a glass, in after years.

Union is less desirable than the immediate mode of union; of lymph-cells being a process so indefinitely separated from blood-cells, that union thereby is much more likely to pass by textural union—in which no lymph is formed; it is probably not so speedy in most cases; and finally, if the wound is not so close, a scar therefore always remaining by the union of the new intervening substance.

REPARATIVE GRANULATIONS and *CICATRIZATION* is that process by which all wounds are commonly healed. It will be distinguished from the union of Contused and Lacerated Wounds. The repair takes place after the destruction of a part by the healing of an ulcer by suppurative granulation; after sloughs, or necrosis of bone, repair is effected in like manner; the closing of the cavity of an open abscess.

HEALING UNDER A SCAB ranks higher, in respect of its result, than the healing by reparative granulations. Open wounds, and superficial ulcers heal in either way. The *cicatrix* formed under a scab resembles the natural textures, and being also less conspicuous, is less disfiguring. Inflammation is apt to supervene, and discharging under the scab, the healing process is again and again recommenced.

The scab itself is formed of dried blood, lymph and serum, or pus; the nature of the reparative process underneath is concealed.

So far—observes Sir James Paget—as one can discern with the eye, the wounded surface forms only a thin layer of cuticle; no granulations, no new fibro-cellular tissue, appear to be formed; the raw surface merely skins over, and it seems to do so by the progressive formation of cuticle from the circumference to the centre, as is usual in open wounds.

It may be aided by various surgical appliances, such as cotton, which being used as a covering to an exposed surface, keeps it moist, and by absorbing any oozing discharge, forms a scab. In a superficial wound or abrasion, with scarcely any discharge, the

the protection afforded by some material, such as collodion colloid, may answer the purpose of a scab.

The Progress of incised wound—as an adhering wound is favourable. But the breach of continuity may be maintained in circumstances which prevent or impede coaptation of the parts. *Weight and mobility* of loose and pendulous parts tend to prevent or to disunite them in the process of healing by primary union. Disturbing conditions which are exemplified after removal of

Muscular action, causing displacement, will have the same effect. *Tension* of the integuments is a similarly adverse condition, whether to any tightness of the part, or as resulting from inflammation. An amputation-stump, after recent operation, is often thus circumscribed at least, by the speedy supervention of swelling, and tension aggravated by scanty flaps. Any *foreign body*, e.g. grit, or clot, intervening between the surfaces, otherwise in apposition, will prevent complete union, and induce suppuration with an open wound. Surfaces of an incised wound are usually clean.

Treatment.—The *Indications* are seven:—(1) Arrest of hæmorrhage; (2) Removal of foreign bodies; (3) Coaptation of the opposed surfaces; (4) Prevent tension of the integument; (5) Provide drainage of the wound; thereby also preventing tension from collection of pus; (6) Keep the part at rest, and in position to permit union; (7) The prevention of decomposition, and infection of the wound, from an adjacent source, as erysipelas.

(1) *Hæmorrhage.*—Small vessels soon spontaneously cease to bleed, the cut extremities retracting and contracting. Larger-size blood-vessels, in jetting streams of florid red blood. Venous hæmorrhage is distinguished by the even flow of purple or black blood. Treatment of hæmorrhage will be described in connection with the treatment of Arteries and Veins. But the arrest of hæmorrhage, spontaneity may be aided by exposure of the wound to cool air, or a stream of water sprays from a (clean) sponge or piece of lint. Gentle pressure with the sponge on the cut surfaces will readily discover when the cut ends are cooling from the bleeding points.

(2) *Foreign bodies.* Any foreign body, if present, should be at once removed. The same application of water, as for hæmorrhage, will aid in the removal of the body, or the body may be removed by the use of a wet sponge, or removed by the use of a pair of forceps. The coaptation of an incised wound might be aided, until the wound has become dried and adhesive. Then it might be closed by suture. But the general rule, applicable alike to the treatment of lacerations and deep incisions, accidental or surgical, is to keep the wound open, and to keep it clean, and any foreign body, if present, being removed, the wound is now ready for union.

(3) *Coaptation.*—The adjustment of the opposed surfaces of the wound is the first step. This, however, implies a suitable position of the part, and a suitable position of the integument, and to relax any tension of the integument, with the easy apposition of the surfaces is the next step.

(4) *Tension* is not only to be overcome by a suitable position of the wounded part—in order to relax the integumental edges of the incision; but (5) a “drainage-tube” should be inserted, at the most dependent angle of a deep wound—to prevent any tension arising from the collection of serum, or from after-oozing of blood; and thereby, moreover, to drain the wound of *decomposing animal matter*, in the event of discharge.

(6) *Retentive Appliances.—Dressing.*—The maintenance of coaptation during the process of adhesion, also implies the same attention to *position*, and some kind of retentive appliance; both being necessary to insure *rest*.

The appliances in question are designed to maintain the apposition of either the *lips*, or the *surfaces*, of the wound. Plaster, sutures, or both, fulfil the one intention; a bandage, with or without light compresses, accomplishes the other purpose. In the course of his Dressership, the Student will acquire a practical knowledge of all the details relating to these things in the dressing of Wounds.

The *line of incision*, visible between the strips of plaster, or the sutures, needs only the protection of a strip of wet lint, as “water-dressing,” covered with oiled silk to retard evaporation; and which may be occasionally reapplied without disturbing the healing process. I prefer a covering of *dry lint*, in two or three folds, which affords excellent protection of the wound from any external irritation—the lint itself acting as an irritant, as well as being apt to induce the putrefaction or septic decomposition of organic matter, in the form of blood, serum, or pus. A *bandage* is applied to retain either dressing. *Collodion* is sometimes used for the purpose of temporarily sealing the lips of an incised wound. Applied with a camel’s-hair brush, it should be dried quickly, and in such quantity that one application of the brush may suffice; for collodion is very adhesive, dries almost immediately, and contracts.

After-dressing.—An incised wound should not be disturbed inconsiderately during the process of adhesion. Inflammation can scarcely be said to supervene. In the first instance, it starts this reparative process. Attended with a slight pouting and redness of the lips of the wound, this salutary degree of inflammation should not be repressed; and, being transient, inflammatory fever is not excited, from first to last, if the wound, however extensive and deep, continues to heal by adhesion. The constitution remains calm and impassive throughout the process, taking little or no notice of the local reparation effected by the part itself. Consequently, no antiphlogistic treatment, topical or general, becomes necessary.

The first dressing is not unfrequently the only one nature requires; the wound healing in two or three days, possibly in twenty-four hours. But union is not then secure, nor much before the end of a week in small wounds, and a fortnight in larger incisions. Therefore, during even the shortest period requisite for sound union, the dressings must be changed occasionally; or their reapplication may have reference to the discharge which oozes, in the event of incomplete primary union. *Cleanliness* is the guiding maxim for interference. The *lint-dressing* is to be withdrawn wet, not to disturb the lips of the wound, as yet tenderly united. The *strips of plaster*, also moistened to facilitate their removal, are withdrawn by both ends together gently towards

...be guided by the progress of
vention of inflammation. Within
least, may become useless, or worse
be picked out, wherever, from point
the blush of inflammation is constant
their way through, and so peril the
of the suture with forceps, the thread
then gently withdrawn, so as not to
metallic suture may be divided in the
end is then to be bent back, that it
from the other side. In the event of
the lips of the wound having a tight
of each suture, and a pouting or pro-
all the sutures must be removed for
the lips do not adhere, the surfaces
But if the parts be heavy, and pendu-
stump, yet without tension, all the sutures
the first dressing.

The *removal* of any *ligature* or *ligament*
not necessarily part of the treatment
considered under Wounds of Arteries.
used—are cut off short; they lie buried
and become absorbed.

ANTISEPTIC WOUNDS

To produce septic decomposition and
consequent septicæmia or septic blood
necessary: 1. The presence of organic
of blood, serum, or pus; and, 2. The
ever theory may be propounded as to
in the putrefactive change of such
the formation, or the accumulation of
the admission, or to counteract the
cardinal principles.

ected by position, or by a tube—the method of Chas-
compression, for the prevention of any accumulation of

se methods have regard to other purposes than solely
of the material for putrefaction. Thus, by irrigation or
temperature of a wound may be reduced to that which
the healing process—the principle involved in Esmarch's
his method; and immersion was adopted by Langen-
to the exclusion of air in the treatment of wounds.

ION TO THE SEPTIC OR PUTREFACTIVE INFLUENCE OF AIR,
and Deodorization have, of late years, attracted much
specially in the treatment or dressing of Wounds, whether
accident or by surgical operation. Disinfection represents
on or destruction of the infectious property, whatever
the atmosphere, or in any liquid, or solid substance, as
clothing—whereby a disease, itself infectious, is com-
propagated; Deodorization signifies only the neutra-
doriferous property, and possibly, simply by masking
re powerful and penetrating odour. Thus, solutions of
lorine, and chloride of zinc are Disinfectants; whereas
solution of permanganate of potash is an excellent

in relation to the treatment of Wounds, accidental or
e termed Antiseptic; the object being to prevent the
any blood or liquor sanguinis extravasated, or of pus
ntly, and it would seem to also control the formation of

Thence, primary union of the wound is favoured, and
urulent infection of the blood—Pyæmia—or to the de-
imal matter—producing Septicæmia—is prevented.

le of Antiseptic Treatment is twofold:—

exclusion of air, as the infecting agent, from the wound.

interposition of some positively disinfecting or anti-
in the form of a close covering to the wound. Sir
who has mainly originated antiseptic treatment, enlarges
e principle, thus:—"An antiseptic to exclude putrefaction,
e to exclude the antiseptic, will by their joint action keep
from abnormal stimulus."

e may be fulfilled as follows:—

on of air from a wound may be effected by simple water-
ly described; care being taken to apply the dressing so
e covering, and which is enveloped in oiled silk, enclosed
y lint, the whole being retained in position by a bandage.
ic dressings of various kinds have been employed; and
treatment, comprising many details, apparently essential
s a specific method, this has been named by Lister the
tem of Treatment."

protective" should possess several properties; it should be
erious to carbolic acid, and unstimulating in its own
e same time, it must be insoluble in discharges, and
le to apply itself readily to the part. The "protective"
from oiled silk, by having a thin coating of copal varnish

case includes, for the most part, that which should be adopted.

During an operation, many particulars must be observed as being to the security of "antiseptic precautions;" failing any one of these is alleged that the "system" breaks down, and cannot therefore be answerable for the result. Mr. Cheyne, in his elaborate and extensive work on "Antiseptic Surgery," puts the case thus:—"The whole, as far as regards the avoidance of putrefaction, requires as much as it were an experiment performed in a laboratory on putrescible matter to fairly represent the method of Listerian Antisepticism, take for example of operation, the removal of a fatty tumour:—"The patient is first brought under the influence of chloroform or other anæsthetic, and the tumour, and for some distance in the vicinity, is thoroughly purified from any active dust by *washing* it well with a solution of carbolic acid, 1-20. The Surgeon and his assistants also wash their hands in a 1-40 carbolic solution, while the *instruments* are put to soak in a 1-40 carbolic solution. A towel is arranged close to the tumour, generally on the part of the body between the operator and the patient, which towel has been well washed in a 1-20 carbolic solution, and is meant as an antiseptic basis, on which the *instruments* may be laid during the course of the operation without risk of contamination. This towel is so arranged as to be within the reach of the spray. A *spray* being now made to play over the part from a short distance, the Surgeon makes his incisions, removes the tumour, ties the blood-vessels with *carbolized catgut*, introduces a suitable *drain*, sutures the wound, and applies a piece of *protective* but little larger than the wound—the *protective* being of course dipped in the 1-40 carbolic solution. Then this is applied a piece of *wet gauze*, consisting of several layers of gauze which has been soaking for some time in the 1-40 carbolic solution. This wet gauze and *protective* are called the *deep dressing*. The gauze must overlap the *protective* in all directions. Then any remaining hollow is filled up with loose gauze, and outside the whole a *dry dressing* is fixed. This dressing consists of a piece of carbolic gauze of suitable size, folded in eight layers, and having the *mackintosh* placed in the outermost layer, with the india-rubber side inwards. The dressing is fixed by means of a *gauze bandage*, and when this is accomplished the spray may be stopped. Then around the *edge* of the dressing an *elastic bandage* is applied, so as to keep the *edge* constantly in contact with the body, and to allow no interval to occur between the dressing and the skin during the movements of the patient. The elastic is carefully fastened to the edge of the dressing by means of safety pins."

The error which most frequently happens in the course of this process, is the using or even touching of some material—as a *sponge*, *instrument*, or towel—which had not been previously purified; and this little incident may be the source of failure to secure a thoroughly successful operation.

After-dressing.—The time for changing the first dressing is determined by the presence of any discharge at the *edge* of the dressing, or by any change in the wound. As a rule, the dressing ought to be changed only on the day following operation; and it should never be left on longer than a week; the carbolic having then evaporated, the action of any discharge would assuredly infect the wound. By

removing the deep dressing, as well as the superficial, the state of the wound is seen as to tension on the sutures, and whether drainage is needed. Otherwise, after the first day, the deep dressing need not be removed. *Changing* the dressing, the spray is turned on, and the Surgeon washes the hand with carbolic solution. The dressing is removed by lifting the margin, and the spray is made to play into the interval between the dressing and the skin, as the deeper portion is withdrawn and the wound exposed. A fresh piece of protective—dipped in carbolic solution, 1-40—is applied immediately, and then the part is washed around the wound with the carbolic spray, nor to any contamination in cleansing the surrounding integument. The edges of the wound need not be cleansed of any matter which is not putrefactive matter; thus also avoiding irritation of the healing margin. Over the protective, the deep dressing of wet carbolic gauze is placed, followed by the dry-gauze folds, as before.

2. In the treatment of a wound produced *accidentally*, the Surgeon has to deal with an open surface which is probably *already infected*. He cannot command the lesion from the beginning, as in an operation-wound. The first object, therefore, is to disinfect the absorbing surface, if possible, so as to reduce it to an aseptic condition.

Previously to applying the antiseptic dressing, as already described, the wound should be well syringed out with the strong carbolic solution, 1-20. But, in injecting a cavity, care should be taken not to distend it by allowing free vent to the return stream from the syringe, lest the irritant fluid be forced into the surrounding cellular texture.

When *putrefaction* has actually commenced, say, after forty hours, carbolic oil, 1-5, or chloride of zinc solution, are the best, and are repeated for several days, to reduce the wound to an aseptic condition.

In dressing either a recent, or a more advanced, wound, the dressing around the seat of injury is well washed with the usual carbolic solution, 1-40. Then, the protective, gauze-dressings, mackintosh, and gauze-bandage, are successively applied.

While thus describing the antiseptic treatment of an accidental wound, the employment of ligatures, sutures, and drainage are understood to be included, as with relation to an operation-wound.

CARBOLIC-ACID BLOOD-POISONING.—Whatever may be the local constitutional advantages of antiseptic wound-treatment, there is no doubt that the occasional supervention of blood-poisoning from absorption of at least one antiseptic agent—carbolic acid—is a disadvantage.

The *symptoms* vary according to the degree of toxic disturbance. In the less severe degree of carbolic poisoning, there is some *gastric disturbance*; chiefly loss of appetite, nausea or obstinate vomiting, and excessive salivation—the increased secretion of saliva becoming frothy, and the patient spitting it out with difficulty. Febrile disturbance invariably occurs, with increased temperature; and cerebral symptoms supervene, chiefly giddiness, stupor, visual disturbances, perhaps dilatation of pupils, and noises in the head; this condition passing into more severe *collapse*. But the *urine* exhibits a peculiar change of colour, acquiring a dark olive-green hue, after the fluid has stood for some time, or appearing this appearance when passed. The test given by Vulpian is,

staining carbolic acid on sulphuric acid in a test tube, when a layer will appear between the acid and the urine.

Treatment of carbolic poisoning, the antiseptic must be immediately discontinued; but some other may be substituted to maintain an action on the wound. To counteract the symptoms, the hypodermic injection of sulphate of atropia is recommended by Nussbaum, for vomiting and salivation; and with collapse, the administration of camphor, in like manner, may be of some service, by stimulating the surface. Baumann proposes sulphate of iron as an internal antidote; the carbolic acid being eliminated in the form of a compound with sulphuric acid.

Eczema sometimes occurs from the topical irritation of the wound, the crude paraffin often used in the preparation of the gauze. A cream—itsself a good antiseptic—is perhaps the best protection of the integument against the irritation of carbolic appliances. Oil is also far less irritant than carbolic acid.

BACTERIA IN SURGERY.

The study of bacteria in Surgery has, since the first publications of Joseph Lister, been assuming increasing importance, and at the present time much that was formerly obscure in the progress of wounds, is now generally known, and has had a great deal of light thrown on it by recent researches. The bacteria are minute vegetable bodies belonging to a low order of life, and living in dead organic matters in process of decay, or in many cases as parasites on the living body, causing various diseases, and even the death of the animal. They are classified, according to their form, into four great groups: (1) cocci, or round bodies; (2) bacteria—minute oval bodies about the size of a needle as they are broad; (3) bacilli—short or long rods; and (4) spirally twisted bodies.

Local Diseases associated with Bacteria.—See Author's "SCIENCE AND PRACTICE." Original Article by W. Watson

WOUNDS OF ARTERIES AND VEINS.

Wounds of Arteries.—A wound of an artery, like that of any other vessel, may be incised, or lacerated; either of which lesions may be complete.

1. *Partial*, partially extending through the calibre of an artery, and equivalent to a punctured wound, varies in *direction*; being longitudinal, oblique, or transverse, and these are important practical considerations; so also is the variation in size of an aperture, which may be of considerable extent, short of complete division of the vessel.

2. *Complete*, partially extending through the coats of an artery, is a more serious lesion, as it involves one or more of its three coats; the external, and more or less of the middle coats, may be torn through, leaving only the thin inner coat; or, the two inner coats are severed, leaving only the thick cellular coat untorn. Lastly, all three coats are torn through, and the lesion is complete; but the external cellular coat and cellular

sheath, being tougher than the two inner coats, are drawn out from them, which also retract; thus forming a canal of loose cellular tissue.

The *Signs* of any such wound of an artery are *hæmorrhage*, blood having a *florid red* colour, and *jetting* out from the vessel *saltum*, with each beat of the heart; not escaping in a continuous stream of purple or black blood. The blood coming from the *distal* part of the vessel is *dark*, and runs in a *trickling stream*, excepting from the *arteries*, the palmar and plantar arches, which when wounded *arrest* blood from either extremity of the vessel.

Causes, and Effects of Wounds of Arteries.—An artery is incised or cut with a sharp instrument, punctured with a pointed one, contused or lacerated by a blunt one, or wounded by force of a bruise or wrenching kind.

The effect of any such lesion *locally*, is to produce aneurism, blood being imprisoned in the textures; constituting *traumatic aneurism*—diffused, or eventually perhaps circumscribed. Its formation is specially described in connection with aneurism. *Constitutionally*, whether arterial hæmorrhage takes place external or internal, as into one of the great cavities of the body, its effects are manifested by *syncope* or fainting, more or less complete. And this may occur either by failure of the heart's action—*cardiac syncope*, and of the circulation, or as loss of consciousness—*cerebral syncope*; or modes of syncope may be produced.

The further *symptoms* of *syncope*, or *collapse* from hæmorrhage, resemble those of nerve-shock. The *pulse* is *feeble* or imperceptible, the skin is *pallid* and *cold clammy* to the touch, and lividity of the lips, toes, lips, and eyes; but in this condition, the *countenance* assumes a leaden and clayey hue, with a haggard and alarmed, anxious expression—such as is presented in the picture of a person who is assassinated, and after a few *oppressive sighs* or gasps, with convulsive twitchings of the limbs, death may take place immediately. Or, if the hæmorrhage be less considerable and sudden, the symptoms of syncope are less marked; the patient turns pale and chilly, faint and sick, but becomes *restless*, and tormented with a *raging thirst*. If this continue, the respiration becomes oppressed; the patient resists, throws his arms up and from side to side, or suddenly lifts his head from the pillow, as if for relief, in *panting* for breath; the pulse fails and intermits, as the breath is drawn in long, convulsive sighs, thus *asphyxia* proves fatal, if death do not occur suddenly from the hæmorrhage. These constitutional effects, and the probability of their resulting, are proportionate to the quantity of blood lost; not necessarily by its escape from the body, but even when lost to the body as by internal hæmorrhage.

Reaction after loss of blood is the return of the heart's action and the circulation. This state is denoted by symptoms of vascular nervous excitement, which, after considerable loss of blood, constitutes *hæmorrhagic fever*. The *pulse* becomes *rapid*, but feeble or *jerking*, *irregular*, *loose*, or *thready* also in proportion to the anæmic condition of the blood-vessels. With returning warmth of surface, the face flushes and the eyes acquire a lustrous brilliancy, while a *restless excitement*, bordering on delirium, and which perhaps terminates in

and convulsions. Or the reaction may be intermittent; pallidity soon recurring, followed by some return of the circulation. *Age* affects the issue, and in favour of youth. *Arterial hæmorrhage* is less consequence than venous. *After death*, the appearances are remarkably anæmic; the surface generally is blanched, of fish-white, semi-transparent cast, but the finger-nails, toes, and congested and livid.

Arterial hæmorrhage is so named where the bleeding occurs, or after an interval of a few hours, more or less, subsequent to the lesion. (See AMPUTATIONS—*Stump*.)

HÆMORRHAGIC DIATHESIS, also named HÆMOPHILIA, signifies constitutional predisposition, whereby the *slightest breach* of surface—a prick—is attended with a *persistent oozing* of blood; the vessels apparently possessing no contractility, and the blood no power of coagulation. But the bleedings may occur *spontaneously*; sometimes by symptoms of plethora. Thus, in childhood, from parts of the mucous membranes, spontaneous hæmorrhages are frequent; from the nose, mouth, intestine, or lungs. Interstitial hæmorrhages or ecchymoses, in the connective tissue of various parts, or blood-tumours, are not uncommon—whether arising spontaneously or from slight injury. The joints are frequently the seat of effusions into the synovial capsules; forming intractable swellings, as in rheumatism; and which seem to control temporarily the tendency to hæmorrhage elsewhere. The knee-joint is commonly thus affected, and relapses are frequently met with.

Diathesis is *always congenital*, and *usually hereditary*. The hæmorrhagic diathesis rarely manifests itself at birth; yet generally during the first years of life, sometimes, however, not until the commencement of adult dentition.

The predisposing influence of sex is shown by the fact, that males are much more frequently “bleeders” than females. But marriage on the part of males does not appear to transmit the diathesis. On the other hand, the children of women who are bleeders, almost invariably inherit the hæmorrhagic tendency. And in bleeder-families, males, who themselves are affected, rarely beget the diathesis, by marriage with women from non-bleeder families; whereas, the children of women, themselves unaffected, who marry into hæmorrhagic families, are very often hæmorrhagic. In hæmophilia, if the hæmorrhage be spontaneous, as often manifested by epistaxis, it may be hereditary.

Women—when the subjects of the diathesis—are seldom so much affected by the typical hæmorrhages of “bleeders;” but exhibit the same tendency by menorrhagia, and floodings after parturition. Persons born with the diathesis seldom outlive it; for if they do not succumb to hæmorrhages in earlier years, they never lose the tendency to hæmorrhage in old age.

Hæmophilia must be distinguished from other constitutional conditions which give rise to hæmorrhage; as witnessed in persons who are weak and debilitated, and who easily bruise from trifling injury, with perhaps a tendency to ecchymosis; or again, as occurring in various blood-diseases, as in scorbut, scurvy, albuminuria, and jaundice.

Treatment.—This leaky state of the capillary system is but little amenable to any remedial treatment. Styptics or astringents, when they

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if possible, in a temperate clima
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Reparation of Wounds of
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1. Immediately after its division the *artery retracts* by its longitudinally into its sheath, which thus projects loosely; *all* of the vessel *contracts*, even to a pinhole opening, owing to its *contractility*—circularly. The retracted portion thus has a conical shape, like that of a Florence oil-flask or ret-bottle. Contractility may be sufficient to close the wound and prevent further hæmorrhage. In this way small arterial wounds spontaneously cease to bleed in an open wound exposed to the action of cold water; but the artery having retracted, *coagulated* within the loosely projecting filamentous sheath, which is filled with blood as it flows; and this event may be aided by cessation of the heart's action—cardiac syncope—source of Nature for the temporary arrest of hæmorrhage. The clot proceeds concentrically. 2. The *clot*, at first pervious and containing a small central stream of blood, soon forms a solid mass, enlarging, passes up the bore of the artery for a short distance, forming a small cone. This portion—internal coagulum or *bouchon*—within the sheath—external coagulum or *couvercle*—together in shape like a *glass stopper* fitted into a decanter. The nature's product is not quite so finished off, for a small portion is insinuated between the sheath and artery beyond the contraction, thereby compressing the arterial aperture, while a portion of an irregular shape projects beyond the aperture of the vessel.

The whole clot is, however, continuous, and with these still bears the resemblance suggested. 3. The *permanence* of the vessel is effected by the effusion of *plastic lymph*. Plastic fibrin, its *organization* consists, essentially, of fibrils; plastic lymph result from the elongation and attenuation of fibrils, in various stages of development. *Corresponding in the clot*, i.e. at the aperture, around it slightly, and extending beyond the vessel, the lymph intervenes between it and the clot, which it replaces. During this change the clot varies in appearance, becoming partly lymph, and partly ordinary coagulum.

The *end* of a divided artery is closed up much in the same way. It contracts less than the cardiac end; and the internal coagulum is altogether absent, or very imperfectly formed in many cases. Consequently, secondary hæmorrhage is more liable to occur at the distal end of an artery, in the course of repair after division.

A *lacerated* wound of an artery, if *partial*, may extend through the internal and middle coats, leaving only a thin undivided inner coat, which still continues the channel of communication. Hæmorrhage is imminent. Or the laceration may extend through the inner and middle coats, leaving the outer cellular coat entire. Hæmorrhage is less imminent, and gangrene may supervene. But if the *two inner coats* be torn, reparation generally takes place and secures the vessel. This is the kind of injury purposely inflicted by the Surgical Ligature, which leaves the external coat undivided; and the wound, self-noxious, as a foreign body in the very pathway of reparation, becomes sealed with plastic lymph, plugged up also with ordinary coagulum.

A *complete* laceration of an artery—*all* the coats being torn through

—heals without hæmorrhage, or scarcely any. The process is as that which takes place after division of an artery by incision: the *cellular sheath* and outer cellular coat are *drawn off* the coats, which retract. Consequently the clot that forms with the projecting portion of loose sheath is larger than when the vessel is cut across; presenting a bulb-shaped extremity, which may be half an inch or an inch in length. Hæmorrhage is thus prevented in many cases where a limb has been torn off, without the loss of any blood; the arteries being plugged.

Treatment.—Arrest of hæmorrhage is the first indication. *Small* arterial vessels spontaneously cease to bleed, immediately. Thus, if the vessels be divided entirely across by incision—as in most wounds, their cut extremities retracting soon offer adequate resistance to the escape of blood. A natural provision will be insured by exposure of the wound to a stream of cold water squeezed from a sponge. Gentle pressure with the sponge will readily discover whether there be still bleeding from the bleeding points. *Larger-sized* arteries bleed in jet from the florid blood, and the further resources of Surgical Treatment are forthwith necessary to meet such hæmorrhage. They can be arrested by (1) Astringents, including Cold, and Styptics; (2) Cauterization; (3) Compression; (4) Ligature; (5) Acupressure; (6) Torsion.

(1.) **ASTRINGENTS.**—Cold may be applied in various ways; as by a stream of cold water, or by exposure to cool air, or by immersion in an ice-bag, or as ice-water. Cold applications are most eligible for the arrest of *general bleeding* from a large surface, or in the event of persistent oozing hæmorrhage; and where the bleeding proceeds from an internal cavity, as the mouth, rectum, or vagina, when it may be arrested by the injection of ice-water. After a wound has been dressed, the recurrence of hæmorrhage can often be stopped by continued or a dropping stream of cold water by means of a syringe, or by the application of an ice-bag. *Styptics* are various astringents, such as styptic colloid, tincture of the perchloride of iron, or styptic oil, oil of turpentine, solution of alum, tincture or infusion of catechu. These agents are used by means of a brush or a fold of lint saturated with the styptic, and applied to the bleeding surface. Other styptics may be administered internally; as gallic or tannic acids, lead, opium, &c. All such agents are appropriate under similar circumstances to those for the employment of cold. But external agents are apt to induce a thin layer of slough, and thus prevent primary union. And internal styptics are hardly prompt enough in their action. Solid opium, given in a full dose, is accredited with the power of arresting any oozing of blood from a number of small vessels, or operation. The hæmorrhagic diathesis also may perhaps be arrested by oil of turpentine.

(2.) **CAUTERIZATION** may be effected by the *actual* cautery, as by means of Paquelin's galvano-cautery, or by the *potent* cautery in the form of potassa fusa or nitrate of silver. Cauterization is serviceable when the hæmorrhage proceeds from *one or two points*, and in an otherwise inaccessible situation. But on the formation of the eschar, or slough, in about a week, bleeding is liable to recur.

PRESSION—*mediate*, as it is sometimes termed, when not tied to the bleeding vessel—may be effected either by the *turniquet*, placed over the parent artery, at the most eligible point between the wound and the heart. Pressure thus applied is only a temporary resource. *Immediate* compression is effected by pressure directly over, or to, the bleeding vessels. Direct pressure may be effected by the seat of the bleeding vessels by a pad of dry lint or cloth, secured in position with sufficient firmness by a roller-bandage. The wound having been thoroughly cleansed and closed, it can thus be arrested; and after amputation, the flaps of the wound can be compressed with a broad pad above and below, the turns of a bandage. *Cavities* admit of being plugged with a mass of lint or piece of sponge, saturated perhaps with some astringent; as in bleeding from the nares, rectum, or vagina, or after removal of the eyeball, or from the socket of a tooth, in the case of continued bleeding after tooth-extraction. Direct pressure can be brought to bear, even more effectually, by means of a *clot-compress*, applied to the bleeding vessel. This form of compress consists of a series of pads of dry lint, from the smallest to the largest, which is placed on the bleeding point, over which another is placed, and as many more, each of increasing size, as will reach the level of the surface; thus making a conical-shaped compress, resting upon the wound in the vessel, and the whole being secured by a bandage. In applying the first plug of lint, the cavity of the wound is sponged out, while the main artery is commanded above, and the bleeding vessel may be fairly seen, before laying down the first plug, which represents the clot-compress of nature. The graduated compress should be allowed to remain until the wounded vessel has contracted without the risk of hæmorrhage recurring; the requisite time being from about a week to a fortnight. This mode of direct compression is specially applicable to the wound of a single artery, and cannot be secured otherwise; but direct compression, in either of the above forms, is suitable only, or chiefly, for the control of *small* arteries, where the support of bone affords counter-pressure.

FIGURE.—The ligature is a Surgical appliance in imitation of the natural ligament, partially extending through the coats of an artery, and consisting of its two inner coats, which are thin and fragile, leaving the outer coat and cellular sheath unaltered.

The *included* portion of external *cellular coat* and *sheath*, having continued compression, *sloughs*, and is detached with the period varying from twenty-four hours or so to about three days, chiefly according to the size of artery. 2. Hæmorrhage will be inevitable; but, pending the detachment of the slough, a *plastic lymph*, from the *vasa vasorum*, takes place, and the two inner coats, divided, become adherent across the area just above and below the ligature. At these points they, when divided, and, converging, meet together. Thus, the artery is *reliably sealed*.

The vessel having ceased to convey blood when the ligature was applied, it slowly contracts, and thus tends to reduce the size of the canal to close the canal,—just as when, at birth, the blood

is diverted from the umbilical arteries; and concurrently, the blood, *en masse*, above and below, to the nearest collateral branch, has undergone coagulation in the shape of *two conical clots*, the ends of which accurately plug the artery on either side the thread. The distal clot on the cardiac side tails off, usually opposite the first collateral branch above, through which the stream of blood, now diverted from its course, is carried off from the main. The distal clot is also defined. This double clot-formation in, and plugging of, the artery begins in a period varying from one to eighteen hours, after the ligation of the blood, as induced by the ligature. 4. At first the clot has the appearance of ordinary coagulum, especially at the base; subsequently it becomes mottled with paler spots, and its substance softens, and ultimately acquires a buff colour, firm consistence, and a fibrous texture; some adhesion also takes place between the clot and the wall of the vessel. In the course of this transformation of the clot, the red corpuscles wither and disappear; but the white corpuscles persist, and form a network, which pervades the whole substance of the clot, thus converting it into a fibro-cellular texture. Blood-vessels, proceeding from the lymph immediately above and below the ligature, shoot from the base of either clot, and gradually extend towards its apex, according to the observations of Stilling and Weber, the new vessels are formed in the clot independently, and then become continuous with the vasa vasorum. Finally, these organized fibrous clots are incorporated with the lymph at their base, which has acquired a similar structure; the coats of the unused portions of artery remaining, also assume a fibrous character; and the whole is converted into a small, firm, impervious, *fibrous cord*, extending usually to the first collateral branch above and below. Nature having safely sealed the artery, under compression by the ligature, and securely sealed the wound, has now obliterated the portions useless as a blood-conveyer. All these changes take place probably more rapidly on the distal than on the proximal ligature.

Application of a Ligature.—A ligature should be applied *cut* through the two inner coats of the artery, leaving only the outer, more-resisting cellular coat and sheath. Hence the ligature should be a small, round, and strong thread—fine silk twist waxed, hempen, or whipcord, or catgut, being found to answer best. Applied with a tightness for this purpose; and also to induce sloughing of the artery, by *strangulating* compression. Applied *transversely* across the artery, of the vessel, observing to press the loop down well upon the artery with each forefinger, so as not to include the point of the forceps; then, in tightening the loop, to press the threads in like manner, towards, adjoining the loop, that its hold may be retained; tying with a *reef-knot*. Failing these precautions, with regard to the application of the ligature may shift its position, and loosening, hæmorrhage supervenes when adhesion is not yet sufficiently advanced to seal the vessel. For the same reason, a ligature should be applied as *not* to include any *extraneous* texture—a bit of muscle, or a nerve; for then the twofold effect on the artery enclosed may be produced, or sloughing may proceed more speedily in the enclosed

man in the arterial coat, the ligature become loosened, and hæmorrhage occur. Inclusion of a nerve-filament causes also great pain, and for a considerable period in some cases. Bleeding points temporarily secured by the application of *catch* forceps, which catch and retains its hold. Several such forceps may be used to arrest hæmorrhage from an extensive wound, while the main vessel is secured. This most useful instrument, devised by Sir Spencer Wells, is employed in the course of various surgical operations.

A *bedded* artery may be inaccessible without including some other structure. In the most inaccessible situations—as when, by amputation, the femoral or tibial artery is divided at its origin and deep in the muscles of the heads of the tibia and fibula—it is absolutely necessary to include an artery so placed. When the vessel is set in condensed tissue, it may be equally difficult to seize with forceps. A curved needle with a ligature is in this way carried round the vessel, and the ligature is tied as usual, but including as small a quantity of extraneous tissue as possible. Or Bigelow's artery-forceps for securing a deep artery are most serviceable. On the other hand, the ligature should be applied to any *projecting* portion of the artery; the vessel being secured of its own nutrient vessels (*vasa vasorum*), plastic lymph is added, and when the slough-ring separates, hæmorrhage is inevi-

table. *Silk*, or the same material, as a chromicized ligature, has the advantage of being absorbed or dissolved; and *both* ends of the ligature may, therefore, be cut off short. The noose usually holds for some days, as secondary hæmorrhage rarely occurs, from a large-sized artery, the brachial or the femoral. Carbolized silk—known as “Chinese twist”—may answer equally well as an *antiseptic* ligature, but this material is more apt to imbibe any decomposing matter or pus; and therefore the ligature is less likely to be permanent—remaining as a foreign body, although it may become encapsulated in fibrous tissue—and thus rendered inert. The ligature should be removed, which would preclude its absorption.

COMPRESSION, as a substitute for ligature, is essentially the “*metallic compression*” of an artery. This method of arresting hæmorrhage, although most ingenious, has fallen into disuse.

TORSION OF CUT ARTERIES is another method of arresting hæmorrhage, which may be regarded as an imitation of another natural process. Torsion is effectual by laceration of the two inner coats of the artery, the bleeding artery; the outer coat remaining as a loose filament, which, entangling the blood and forming a peg, is equivalent to a *dentally complete* laceration.

Torsion consists in the following *changes*:—At the seat of torsion, the inner coats of the artery are torn across, and reduplicated up the shaft in the form of a *complete funicular sheath*, one-fifth of an inch in length; and at the upper or smaller opening of this reduplication a *conical blood-clot* forms, occupying the bore and extending up the shaft.

The *twisted* condition of the artery—outer coat—itself usually changes, and the reduplicated sheath of the two inner coats, acting as a valve, are quite sufficient provision against the re-occurrence of hæmorrhage at the time of operation and subsequently; but

there is also the supervention of clot-formation from this abscath, and extending further up the bore of the vessel.

Different *modes* of torsion have been recommended, and are practised. The artery may be drawn out for about half an inch by one pair of serrated forceps, and its attachment seized by another pair of serrated forceps; the free portion is then twisted off by about a dozen turns of the former instrument. Or, the end of the vessel may be simply twisted several times, without detaching it. This is the method I ordinarily practise. *Torsion-forceps* are now in general use; an instrument furnished with transversely serrated points, and closed by a slide when the end of the vessel has been seized.

Wounds of Veins.—The same forms of injury may occur as those to which arteries are liable, and they having been already sufficiently described, need not be repeated.

The *Signs* of any such wound are venous hæmorrhage; the blood of a purple or black colour, and flowing in a continuous stream, unlike the jetting of florid red blood from an artery. The size of the stream soon diminishes, and hæmorrhage may be arrested, by collapse of the thin walls of the veins; while any return flow from the cardiac end of the vessel is stopped by the valves, unless when the bleeding proceeds from valveless veins, as those of the portal system. Veins of the largest calibre, as the internal jugular, subclavian, axillary, and femoral, continue to bleed copiously; but the stream is intermittent during inspiration, and accelerated by expiration. Pressure on the vein between the aperture and the heart, a dependent position of the part, and muscular action in the course of the current, favour the hæmorrhage; while the opposite conditions retard it.

CAUSES, AND EFFECTS OF WOUNDS OF VEINS.—Like an artery, a vein may be incised or cut with a sharp instrument, punctured with a pointed one, contused or lacerated by a blunt one, or injured by force of a bruising or wrenching kind. The effect of this lesion, *locally*, is sometimes to induce inflammation of the vein—phlebitis, if the wound be an open cut, or to produce a collection of venous blood—blood-tumour, if the fluid be imprisoned in the textures. *Constitutionally*, whether venous hæmorrhage takes place externally, or internally into one of the great cavities of the body, its effects are manifested by *syncope*; either by failure of the heart's action—cardiac syncope, and thence of the circulation, or by loss of consciousness—cerebral syncope; or by both these effects, and their fatal termination if the hæmorrhage be sufficiently prolonged.

Reparation.—Wounds of Veins heal by processes apparently analogous to those whereby similar Wounds of Arteries are repaired.

TREATMENT.—The arrest of venous hæmorrhage may be accomplished by an elevated position of the part, and the pressure of a compress secured by a few turns of a roller. Cold or astringent lotions are also of some service. Ligature should be avoided, as being apt to induce phlebitis. But this resource may be necessary in the case of a large vein, or if the vessel be so situated that pressure cannot be applied.

Constitutional Treatment of Hæmorrhage.—*Arterial* or *Venous*.—After the loss of any considerable quantity of blood, whether by accident or surgical operation, the patient should be laid in the *recumbent position*, to prevent syncope; and afterwards, rest in this position will be

when the veins in the root of the neck, or in the axilla, are cut, and causing asphyxia, followed by syncope.

Symptoms.—The *local* phenomena consist in a peculiar sound, of a *gurgling*, lapping, or sucking character, produced by the entrance of air into the vein, and the appearance of *bubbles* about the *wound* in the vein. The *general* effects are equally remarkable; the patient is suddenly overcome by a great *oppression* in *breathing*, and extreme faintness, convulsions, and a horrible feeling of terror and impending danger, which lead him to exclaim that he is dying. A churning noise is heard in the chest, synchronous with the ventricular systole; and the hand applied to the chest, perceives a peculiar bubbling, thrilling, rasping sensation, as if the air and blood being whipped together within the ventricle. The patient's action becomes extremely feeble, and the *pulse* almost *imperceptible*. When only a small quantity of air has entered the circulation, the symptoms may pass off and the patient rally. A larger admission of air causes death, during the convulsive struggling, or without struggling, as if by simple syncope. The *period* at which death occurs varies from a few moments or minutes, to several hours. When the patient survives, some hours elapse usually before consciousness and action are restored. In some cases, after recovery from the immediate effects of the accident, death has ensued from pneumonia.

Prevention.—*Preventive* measures consist in making pressure on the side of the wound, during operation in dangerous localities; and placing the part in a relaxed position, thus to prevent the veins from opening. Any vein of considerable size, and especially in the neck, where a venous pulse is perceptible, should be avoided as much as possible. *Curative* treatment comprises the fulfilment of the following rules:—1. The *wound* in the *vein* should be *immediately closed*, by pressing between the thumb and finger; the urgency of the symptoms requiring any delay for the application of ligature. 2. To maintain the free supply of blood to the brain, for the prevention of death by syncope, the patient should be placed recumbent with the head low.

lesion, therefore, is the connecting link between lacerations, by laceration, as simple fractures, lacerated, or contused wounds, compound fractures, the turning point being exclusion from the air. Subcutaneous laceration of the soft parts, with some hæmorrhage, also beneath the skin, according to the depth of the contusion.

SIGNS.—The blood, diffused into the cellular tissue, especially into the cellular tissue, is said to be discharged out of the body as a portion of the blood which has accumulated under the skin, is made visible through the skin, the appearance of a *livid* or *black* discolouration, a *bruise*, as seen in the first instance, a *swelling*; presenting the characters of a blow. If only a small quantity of blood is designated *ecchymosis*. The *pain* of aching character; or a vibrating sensation of the part, when a large nerve is more exposed, as at the elbow. When extravasation extends into internal organs, it is designated of a less definite character, and which cannot be distinguished from which the contusion extends. Compression may arise from cerebral contusion and extension.

The *Constitutional* symptoms of contusion arise from the *shock* of injury, as manifested by *collapse* from the extravasation of blood.

DIAGNOSIS.—Blood extravasated in the cellular tissue, present the appearance of bruise, but has the character of an *abscess*. A hard *circumference* can be felt. Puncture with a grooved needle, for diagnosis. The discolouration is not

"training," contrasts favourably with the flabby, bloated face of one who is "out of condition," as that of the intemperate debauchee, which is ever bordering on ecchymosis.

Concussion often accompanies contusion; parts distant being shaken, as well as the part at the immediate seat of injury being crushed, by the violence of the force applied. Hence, concussion is more often produced in contusion from indirect violence. Thus, the minute vessels, and nerves, may be concussed or shaken far beyond the range to which actual contusion extends.

COURSE.—1. No perceptible alteration may take place in a contused part, the bruised appearance remaining for a variable period; but *absorption* supervenes, and the originally purple or livid discolouration of a bruise gradually fades away into a brown, and thence into a greenish or yellowish hue, the latter often continuing for weeks or months. 2. Blood extravasated in considerable quantity may also remain stationary for a while, as a *bag of fluid*. 3. Generally, however, any such collection of blood undergoes changes of consistence; becoming thin and serous, and enclosed in a *fibrous cyst*; or thick and dark like treacle, constituting a sanguineous tumour—*hematoma*; or with coagulation, organization of the clot may result, by the development of new blood-vessels. 4. Lastly, the most obvious change may be destruction, prevailing over any reparative effort; the blood, acting as a foreign body, induces *inflammation*, the products of which, commingling, form a bloody purulent fluid, extravasated amid the disintegrated textures. *Gangrene* is imminent, in the form of sloughing, or as traumatic gangrene, thus converting the subcutaneous lesion into an open lacerated wound. Sometimes the extravasated blood rapidly passes into decomposition, accompanied with the symptoms of *pyemic infection*. 5. *Hæmorrhage*, superadded to the blood originally extravasated, is another adverse issue, but even less common, unless in internal organs.

TREATMENT.—A slight ecchymosis disappears spontaneously; a more severe bruise may need help.

The *indications* are, in the first instance, to stop any further extravasation, and then to promote *absorption*, without any breach of the integument. Compression, by the application of a bandage, may perhaps, therefore, have a doubly good effect. A spirit lotion, or any other cold evaporating fluid, is often equally beneficial, and more soothing. Leeches are not merely useless to withdraw the blood, congealed and infiltrated; but by admitting air, and thus inducing decomposition, they are positively noxious. When the blood is in a *fluid* state, it may be drawn off by means of the aspirator; but the cavity is apt to refill again and again. Should suppuration or gangrene threaten, then, indeed, *incisions*, early and free, are imperative, to give vent to blood and pus, which would otherwise rapidly putrefy, and to prevent sloughing, or its progress.

Contused and Lacerated Wounds.—A contused or a lacerated wound is a sudden disintegration of the *soft* textures, with *exposure* to the action of the air.

The *characters* of a lacerated wound are peculiar. It presents a torn, irregular surface or cavity, with more or less *surrounding swelling* and *discolouration*, owing to effusion of blood beneath the skin, or ecchymosis. *Hæmorrhage* from the wound itself is inconsiderable, the vessels being lacerated. With these external appearances, the degree of *pain* experienced

may be chiefly contusing, as the kick of a horse, or the ball or other projectile. Some wounds are characterized by the bites of many animals, as of a dog, or by the character of the instrument; tusk or horn wounds, as by the produce similar lesions, but more in the form of laceration. In some cases the part is damaged beyond, and perhaps to the extent of injury.

COURSE.—The textures, disintegrated by the greater or less extent. This event, which is the commencement of gangrene, on however small a scale, takes place, and may co-operate. Severe contusion or laceration does so indirectly, by damaging the blood-vessels, and in some cases mortification is occasioned by a deficient circulation. In both cases, gangrene is *immediate*, or at least it evinces *no tendency to spread* beyond the limits of the injury. At the same time, it is *defined* by sloughing, or by "a line" which separates the injured part from the healthy. The injury is more extensive.

The *appearances* and *textural changes* may be observed. Completely crushed skin presents a white appearance, and feels cold; or, at first there may be a redness, but in a few days it becomes white and insensible, later it becomes when quite dry, a brownish-black colour. The line of demarcation is a rose-red line, which shades off into diffuse redness about the wound, marking the line of demarcation. It begins where the blood still flows through the cutaneous vessels, fasciæ, and tendons, this appearance is far less marked. The part far they will be detached is uncertain. The progress of the following textural changes:—At the line of demarcation the living tissue, the circulation is arrested by the adjoining capillaries, and nutrition ceases. The formation of vascular loops lead to the death of the part.

immediately by the injury, die *subsequently*. Yet here, also, the gangrene is limited to the seat of injury, and is defined by sloughing.

Spreading traumatic Gangrene is traumatic only in having arisen from injury as the immediate or exciting cause; but its spreading and unlimited character points to some blood-condition, in operation, as the essential cause. In fact, this gangrene is the local manifestation of a *constitutional* condition, rather than the consequence of a local cause. Its pathological significance is corroborated by two facts—that the contusion or laceration is quite subordinate in extent to the supervening gangrene; and that it occurs in those persons especially who have albuminuria, a state of urine indicative of the retention of excrementitious matters, chiefly urea, in the blood.

SIGNS.—Either form of Gangrene—traumatic or inflammatory—is always humid or moist, unlike the dry species of which senile gangrene is the representative. When a part is killed immediately, the appearances are those of the most severe contusion or bruise; when less immediately completed, as by injury to the blood-vessels, the symptoms are the same, but proportionately more gradual; and when *gangrenous inflammation* supervenes, the symptoms are those of inflammation rapidly passing into gangrene. But when *spreading traumatic gangrene* takes place, the phenomena are those of a severely poisoned wound. Gangrene is announced by great tension and livid or purplish-black discolouration, which although most conspicuous about the seat of injury, extends rapidly upwards and downwards; its progress being preceded by a slighter oedematous swelling and greenish-yellow discolouration. This in advance, is a dying part; that in the rear, is already dead. Emphysematous crackling, under pressure with the finger, soon leaves no doubt that death and decomposition go hand in hand. This may be regarded as diffuse cellulitis, involving the other soft textures; and spreading readily in the continuity of the cellular tissue,—subcutaneous and intermuscular, and with the rapidity due to blood-poisoning, a whole limb falls into the state of *humid gangrene* within perhaps twenty-four hours. The accompanying *constitutional* symptoms are those of typhoid blood-poisoning; and the disease generally terminates fatally in a very few days, or not later than whenever the gangrene shall have spread to the trunk.

REPARATION.—In favourable contrast with any tendency to death, the wound may evince a disposition to heal by primary adhesion; or, any irrecoverable part having sloughed and separated, the exposed surface heals by *suppurative granulation*. But this process of repair is best seen on the clean surface of an open or gaping incised wound. The process is then as follows:—1. The local circulation is temporarily suspended, and the blood in the superficial vessels becomes stagnant, and coagulated up to the nearest branches. Any oozing hæmorrhage is thus stopped. During the first day or two, a reddish-yellow serous fluid exudes from the surface of the wound, which, containing pale blood-cells and a fibrous matter, sets into a thin, yellowish-white or greyish film, rendering the appearance of the subjacent tissues indistinct. Thus the whole surface becomes glazed over. Symptoms of inflammation may, perhaps, precede and accompany this exudation; some redness, puffy swelling, heat and tenderness, just around the margins of the wound. But, in a healthy state, this inflammatory character passes off. 2. A period of *inactivity* or calm succeeds.

of its compact disc remains yet covered by lymph-film. These rosy nodules or granules in the deepest granulation-cells are most advanced, elongated nearly into fibres. The superficial cells are in a more advanced state, and at length acquire the character of *endothelial vessels* spring from below, *forming loops*. These are completed by the outgrowth of two pouches from a common base, crammed with blood-corpuscles, shoot up and meet, never fail to meet exactly in apposition, and fuse. They coalesce by absorption of the partition between the two ends, thus completing a vascular loop; through this loop from the main current and rejoining it, is completed the construction of any such vascular arch, the arch is then completed by the propulsion of the blood from the parent vessel being directed through the curved passage through the fibro-cellular tissue. The vascular formation in granulations, has been observed in shaped cells lying parallel, leave a narrow interval, this forms the channel for the blood-stream, the wall of the vessel, while some of the cells are converted into blood-corpuscles. The arrangement of granulations is that of a network, consisting of a direction towards the surface, with communications which are more numerous near the superficial surface. In this structure, the vessels consist of a thin, transparent, bedded nuclei, some of which have a longitudinal direction, in the wall of the vessel. Nerves are apparently enter the substance of granulations.

The process of development having finished, is seen in the shape of small conical papillæ, of which the free surface is free from pus. Pus represents the superficial material, which never reaches the interior.

as between the surfaces of an incised wound. But it takes place in the same way, by the development of fibres out of nucleated cells and the interchange of capillary blood-vessels through this medium of communication. The *contractile* force of granulations is supplemental to repair in bringing down the marginal skin to their own level and diminishing the area of the wound. Thus, then, by their actual growth and possible coalescence, aided by their contraction, granulations and skin at length become even.

Cicatrization commences, its purpose being to cover the granulations with skin. At the *margin* of the wound or ulcer, the granulations become flattened, and cease to secrete pus; appearing as a red, dry, smooth border, about half a line in breadth; this is followed by a translucent, bluish-white border,—the cuticle, in advance of the opaque-white true skin. Converging at the rate of about half a line daily, the surface gradually gets covered. Sometimes little islands of cuticle form, here and there, on the granulation surface, which coalesce, and thus shorten the process of marginal cicatrization. But these isolated centres or patches of epidermis appear only where corresponding portions of the cutis with rete malpighii have remained undestroyed, on the surface of the wound or sore. (Billroth.)

Newly formed and healthy *cicatrix* is *thin* and *red*, with a stretched, shining aspect, and not so supple and elastic as true skin; somewhat depressed, sometimes elevated, but always *attached* more or less firmly to the subjacent tissue. It *contracts* for a long while, and perhaps with considerable force, especially after burns, thus becoming smaller in area, particularly if the surrounding skin be loose or redundant. In the course of months or years, the cicatrix acquires a *pearly white* colour, and becomes more supple, elastic—from the development of elastic tissue—and *movable* as part of the integument. But a cicatrix always remains *permanently*, being more or less visible for life; it never wears out altogether. It is less vascular, and less sensitive than the adjoining skin. Resembling true skin in its fibro-cellular structure, with elastic fibres, its papillæ, and the cuticle, are reproduced, but cicatrix never acquires its glandular elements, neither in the form of sweat-glands nor sebaceous follicles; and it remains destitute of hairs.

ACCIDENTAL COMPLICATIONS—both local and constitutional—may occur in the course of a contused or lacerated wound. (1.) *Secondary hæmorrhage* is apt to happen when the sloughs or gangrenous portion separate; and when, occasionally, a large-sized artery is thus laid open, in about a week or ten days, or from the supuration of a thrombus or fibrinous plug, at a later period, the loss of blood may be of serious consequence. Bleeding granulations sometimes prove troublesome. (2.) The liability to *tetanus* occurring, even when the wound is granulating, should not be overlooked; and especially as arising from exposure of the surface to a current of cold air—a hint to be observed during the dressing of a wound.

(3.) *Progressive suppuration* may take place from a contused or lacerated wound; the pus undermining the integument, extending along the sheaths of tendons, and burrowing deeply between the muscles. The part becomes swollen and sodden, and the granulations pale and œdematous; the pus also has a sanious, fetid character, and is exuded through fistulous openings. This state of the part is more often met with when the hand or foot, or a large joint, was the starting-point of the suppura-

adhesion taking place, to some extent, is solicited with good prospect of success. the treatment should be the same as for bodies, such as grit or portions of clothing, sponge or stream of water, replacement or retention in position by the usual surgical rules of treatment to be observed. The is a consideration of primary consequence, be the damaged textures, and to any liability of an important principle of treatment consists the continued application of cold. This is ways; by immersion of the part in cold wrapping the part in lint, and applying antiseptic dressings and syringing seem cold-water treatment, in being equally pre-influence, without further endangering the organized part, by the prolonged application

2. In the event of primary adhesion having *deep* and *extensively* contused wounds, it helps to encourage and aid the process of sloughing by granulation. The separation of sloughs and moisture, in the shape of a light poultice. At this time secondary hæmorrhage is liable if any considerable size was involved in the collection of matter should be let out, or a counter-opening, and discharge facilitated by the use of a drainage-tube. Otherwise the reparative process; position, rest, and protection from the lint dressing, over a piece of protective, will result in a healthy wound.

Deep and extensively contused or lacerated

ed Wounds.—A punctured wound is a more or less concentrated wound; varying in *depth*, but of greater extent in *length* than superficially. Structures may thus be injured far beyond what appears to be the extent of injury, by the aperture in the skin.

Other kinds of Wound—the incised and the purely contused—may indeed be *complicated* by their depth; a punctured wound is characterized by this additional element. Thus, penetration of the wound may lead to the formation of traumatic aneurism may complicate a wound in any part. Penetration of the brain complicates a wound of the skull; and similar injury of the lung or heart, or more of the abdominal viscera, may complicate a punctured wound of the thoracic or abdominal cavities respectively.

Local characters of a punctured wound are comparatively unimportant and not characteristic. Varying in size, from a pin's point to a thrust or an aperture of larger size, its shape differs with the penetrating instrument; the margin of the aperture is *not* the surrounding integument bruised, if the wound was made by the penetration of a blunt-pointed instrument; and this degree of contusion are the more conspicuous if the weapon was of great size from the point upwards, as a bayonet. The *hæmorrhage* is determined by the quantity of blood which escapes externally. The track of a punctured wound and laceration of the textures, and the escape of blood, and are favourable to the formation of traumatic aneurism. If the wound extend into an internal cavity, as the thorax, hæmorrhage may take place yet more abundantly without a free escape of blood from the aperture externally.

Constitutional effects of a punctured wound consist, partly, of local inflammation; partly and perhaps principally, of *shock* to the system; and here, again, both are generally disproportionate to the local lesion, which by its depth may involve blood-vessels and nerves, and possibly implicate a vital organ. *Shock* is another constitutional condition not unlikely to occur.

CAUSES OF PUNCTURED WOUND.—Any pointed instrument, sharp or blunt—*e.g.* a pin or needle, a thorn or splinter of wood, an old penknife, a bayonet, or barbed weapons, such as a fish-hook, &c.—represents the whole class of causative agents. Contusion is more or less proportionate to the bluntness of the penetrating instrument.

After-effects.—Sloughing ensues, more or less in extent, along the track of the wound, accompanied with suppurative discharge; but eventually it terminates in granulation. If the textures are not much contused nor lacerated, the wound may heal by primary adhesion; and this, although the penetration may have been considerable, extending even into a bone, and involving an important organ.

TREATMENT.—1. The first indication is to arrest hæmorrhage. Pressure of a compress, will generally prove sufficient, unless a large vessel is lacerated, when it will be necessary to ligature the vessel above the aperture, by cutting down in the track of the wound, if it cannot be thus secured. The removal of any *foreign body* is another indication, whenever it can be safely fulfilled. A portion of clothing, if it has been thrust so deeply into the wound, and possibly into

between the ligatures—if this had not
thus to release the artery from any
process of occlusion. (b.) When, how-
ever, textures infiltrated, or sloughing,
the artery itself is found to be diseased,
in such instances, the high ligature may be resorted to.
This procedure should not be overlooked,
occurring by regurgitation from the distal
end, the process of occlusion takes place in the
vessel; besides which, high ligature arrests
hæmorrhage—as when the superficial femoral
still supplies blood below, or owing to the
proximity of the bleeding artery. The possibility
of subsequent ligature of the main artery
is not to be overlooked. Temporary compression might, therefore,

2. Guided by the processes of repair,
ligature should be *attempted* in all cases of puncture.
Success will depend on the comparative
depth of the wound, by the less circumferential contusion, the
size of the body, and the arrest of hæmorrhage.
In the case of adhesion, the process of suppurative granulation
is not solicited, as in the usual treatment of a

A *needle-punctured* wound, although it may
present some difficulty in the extraction of the needle,
if driven in entirely, or having broken through the
skin. This complication may be increased by the
proximity of the wound to large vessels and nerves, as in the
case of the texture; or impacted in a large joint, as in the
case of the sheaths of tendons, as in the finger.
The broken portion, of the broken portion, may perhaps be
detected by the

ed needle, some deflection would indicate the presence of iron, which have been *swallowed*, migrate through the coats of the or intestine, and work their way into all parts of the body, at once coming to the surface in some quite unexpected situation.

CHAPTER XIV.

GUNSHOT WOUNDS.

t Wounds.—Gunshot wound is, essentially, a contused and wound; but varying in *extent* and *depth*. Structures may thus be injured far beyond what appears to be the extent of injury, in connection with the aperture or apertures in the integuments. If any part, as the skin, be shot away entirely, as by a cannon-ball, the extent of injury is only declared. In point of depth, the penetration of an artery, or the formation of traumatic aneurism, may complicate a gunshot wound in any part. Penetration of the brain complicates a gunshot wound of the skull; and similar injury of the lung or heart, or of one or more of the abdominal viscera, complicates a gunshot wound of the thoracic or abdominal cavities in either such a case.

ound Fracture or Compound Dislocation not unfrequently complicate the more severe forms of gunshot injury.

ing gunshot wounds as met with in the Civil practice of Surgery, the use of small firearms—whether for the purpose of suicide or for the purpose of the *depth* of the wound is the more important element for consideration.

e various textures, none suffer so much damage as bone by the action of a conoidal bullet. Piercing and passing through the soft parts, it splits and comminutes any bone in its way, producing fissures which extend into neighbouring joints; the greater destructiveness of the action of a projectile resulting from its wedge-like action, and the peculiarity of the osseous texture. The bullet itself becomes changed in shape; its apex being flattened and reverted, if it strikes point-blank; or planed from its apex towards its base, when it strikes obliquely to its line of flight.

in bodies, of various kinds, are often *lodged* in a gunshot wound, and frequently lie deeply buried.

all may lodge more or less deeply; if a round ball, it may be deflected from its course, by impingement against clothing, or by the resistance of bone or other texture, and thus take perchance a most circuitous route—lying buried in some distant part; whereas, a conoidal bullet is more apt to pass straight through,—producing an aperture of exit as well as one of entrance.

kinds of foreign bodies, and of various shape, as a gun-wad, or a piece of wood, portions of clothing, etc., are not unfrequently retained deep in a gunshot wound; any such substance being

be linear or crucial, or variously shaped, torn, and surrounded with an areola of pur of exit is larger and more irregular, its margin showing the subcutaneous fat, and with less unfrequently, there is no actual aperture, the integument, the tough and elastic part sufficient resistance to prevent the formation which case, the ball can be felt lying unopposite to the entrance-aperture.

2. *Hæmorrhage* of an arterial character and sometimes proves fatal almost instant blood is seen, and then and there a pallid the accompanying laceration secures the vein of any considerable quantity of blood, at division of an artery is attended with pain cannot take place. Puncture by a spiculum cause primary hæmorrhage; but a bullet in vein in contact, as the femoral vessels, with their elasticity apparently preserving them.

3. The *pain* of a gunshot wound is variable. In the first instance, it is either like the smart of a heavy blow; differences due, perhaps, to the depth of the injury. For a short time after the injury, the pain may be referred to a part remote, numbness; pain succeeding, and with increasing and tension supervene.

The symptoms connected with the penetration perchance the viscera—are specially significant of the part, which is thus injured; but as the pathology of gunshot wounds, they are here

4. *Shock*, rather than syncope from

2. Pending this process of reparation, *tension* is often extreme and ensive, and *suppuration* equally profuse and diffused.

3. *Secondary hæmorrhage* is not an uncommon event. It occurs frequently on the sixth day. (Baudens.) Gangrene, therefore, may ensue, when a main artery is implicated.

An *unextracted ball* plays a singular part in the subsequent history of a gunshot wound. 1. Constant suppuration, and exfoliation if the ball be lodged in bone, are consequences which might be expected. But the ball may move from its first lodgment and travel to some distance, in a devious course, and ultimately find an exit or still remain in the body. Various functional disturbances arise during these peregrinations. 3. Again, the ball may become encysted in dense fibrinous tissue, and then being stationary and isolated in a sac, it occasions no or no inconvenience. Or, a long canal-like cyst may form, in which the ball, although imprisoned, moves freely up and down.

Treatment.—Immediately after a gunshot wound, certain requirements demand instant attention, as to hæmorrhage, position, and shock.

(1.) *Arterial hæmorrhage*, whether in the form of a jetting stream or rapid dripping of blood, must be arrested forthwith. Abundant venous hæmorrhage is scarcely less perilous. If a limb be the seat of injury, a *tourniquet* should be applied, so as to command the main vessels. This may be readily made, by means of a stone about the size of an egg, rolled in the middle of a pocket-handkerchief and placed over the main artery; the ends of the handkerchief being drawn around the limb and secured by a knot, and then twisted up tightly with a piece of stick, or the hilt of a sword passed under it. A compress and an elevated position of the limb are more suitable when the hæmorrhage is purely venous. The wound may be covered with cold wet lint, as a soothing application. If the head or neck be wounded, hæmorrhage, whether arterial or venous, must be arrested by pressure; and cold applied.

(2.) Attention to *position* is important. A limb should be laid in an easy position; and fixed during the removal of the wounded person to hospital, in order to prevent any disturbance of the injured part from shaking or from spasmodic action of the muscles. Thus, a rifle may be held as a thigh-splint. This precaution of fixing the limb, will be the more necessary when compound fracture or dislocation complicates the injury. If the chest be shot through, the patient should be laid on the injured side and cold applied. If emphysema occur, or if air escape freely through the wound, a broad rib-roller should be applied. If the abdomen be wounded, the patient should be laid on the injured side; or, if the wound be central, on his back, with the knees drawn up over a blanket or knapsack. Any portion of protruding intestine or other viscera must be gently cleansed with water and at once returned.

(3.) *Shock*, or sometimes *hæmorrhagic collapse*, may be most perilous; and brandy, wine, or other stimulant must be administered to preserve life. Cold water may be given freely to allay the parching thirst which speedily ensues from loss of blood.

The subsequent indications of treatment comprise—the permanent arrest of hæmorrhage; extraction of foreign bodies; the management of inflammation, suppuration, and sloughing; and the conditions requiring amputation.

moreover, secondary hæmorrhage is a
compression of the main trunk is
seldom requisite to have recourse
for primary hæmorrhage after
leaving a stump, the lacerated
hæmorrhage must still be arrested.
The application of a roller-bandage is
effectual means of preventing it.
But it should not be continued
beyond the first twelve or twenty-four hours.

Other indications for interference
by examining the patient in the position
tained, in which he was relative to the
any other posture, the apparent
also the probable extent of injury
modified by muscular action and
tion of the wounded textures, the
clothing and the entrance-opening.

(5.) *Foreign Bodies.*—To detect the
best searcher or probe. Various
devised; an instrument provided with
viceable. In case of doubt or difficulty
of a *lead* bullet, Nélaton's probe
should be introduced; and if, at the
point receives a metallic mark,
this instrument will thus offer
diagnosis. But it may happen
a streak left on bone by the disintegration
substance of bone has actually
should be introduced lightly, or
track of the ball; any thrust
passage; but if it is thrust in, it will

1008. The bullet-forceps, known as Savigny's, is especially
deep wounds. The blades unlock, and can be introduced
or used as a scoop. Cozeter's bullet-scoop enables the Surgeon
bullet by means of a screw. A bullet lodged in *bone* may be
an *elevator*, aided by gouging away any overhanging portion
any other *foreign body*, as a portion of clothing, which might
for some natural texture, should be searched for with the
removed by manipulation rather than with forceps, which
seize both indiscriminately. Examination of the dress will
show whether a portion was carried with the shot into the
should, however, be remembered that any such fragment may
be withdrawn in undressing the patient.

bodies are *eligible* for removal, according to the patency
of the wound, as their presence can then be ascertained with pro-
certainty; but the relation of surrounding parts will affect the
operation for extraction. Thus, when situated *beneath* the
skin perhaps at some distance from the entrance-aperture,
readily detected and removed by an incision, longer than the
radius of the ball, care being taken to steady the ball lest it slip
out of reach. The bullet is usually found to be more or less
deformed and misshapen, also tightly constricted and held fast by
threads of muscular, fibrous, or cellular texture; the missile,
if deformed, cannot be raised from its bed, and must be set free by
the knife, before it can be extracted, without further laceration
of the textures and unnecessary pain. A conoidal ball generally lies
on its axis sideways beneath the integument, and should be
removed in that direction. On the other hand, when the foreign body
is situated *deeply*, and possibly already out of reach, its detection is
—unless it be a leaden bullet, the presence of which may
be detected by means of Nélaton's probe; and its extraction, in any
case, will be less safely accomplished.

If the foreign body is so placed that it *cannot be distinctly*
detected, should it be inaccessible surgically, the better rule of practice
is to abstain from any further search, as well as any attempt at operative

kind of lesion which requires little
tures may be protected from exposure
of wet lint, or when fresh water can
simple cerate on lint will be a sufficient

(6.) The accompanying *inflammation*
are perhaps best moderated by the
choice of warm or cold and evaporation
by experience and trial in each case
the patient. *Early and free incision*
and thence the accompanying consti-
tutional matter which otherwise ac-
organize the part. This relief of ten-
The irrigation of cold water has
apparently in cleansing the wound of
posing texture, and thence also in the
Subsequently, the process of healing
guides and regulates whatever slight
behalf of reparation.

Of the *untoward* events to which
liable; *secondary hæmorrhage* is the
apt to occur when the sloughs loose
sixth day; but it may happen during
twentieth or thirtieth day, when an-
about the fourteenth day. At those
tourniquet around the limb, in readi-
notice, will always be a judicious pre-
measure to arrest the hæmorrhage.
vessels is imperative, and without de-
if possible; or when impracticable, to
or that failing to command the hæ-
resource. A general oozing of blood

(3) Depressed and Adherent Cicatrix; (4) Raised Cicatrix; (5) Cicatrix of Ulceration, Growths, and Degenerations of Cicatrix.

Deficient Cicatrix.—A thin, flat, shining, reddish, easily dried and cracked scar remains, after the imperfect healing of a weak or scrofulous sore. Such a result depends obviously on deficient power of cicatrization.

TREATMENT.—Pencilling with nitrate of silver, sulphate of copper, or stimulant application, and protection of the surface from any occasion of inflammation or injury, constitute the most probably useful topical treatment. At the same time, the general health must be improved as far as possible, thus having regard to the constitutional condition.

Excessive and Exuberant Cicatrix—Cheloid or Keloid.
ix.—An opposite condition to the preceding; this form of cicatrix is, more or less projecting, irregular, dense, and perhaps adherent. Formation of such a cicatrix is not an uncommon character, and the power exerted may be so powerful and long continued, as to produce displacement and deformity. This result usually follows cicatrization of a burn, particularly if it be deep and extensive.

Cheloid cicatrix is well defined, gradually rising, with a rounded and a smooth, level, or slightly convex, or sometimes centrally elevated surface. Its substance is always tough and firm, becoming harder as it grows older. At first usually more vascular than even a healthy scar, and having a florid or purple tint; it gradually becomes paler as it becomes harder, and at length resembles healthy skin. In point of structure there is nothing peculiar; connective-tissue more or less completely developed or degenerate, slightly vascular, is covered with a thin cuticle. The *size* of a cheloid is generally distinctive; rarely more than half an inch in thickness, more than half an inch in any direction beyond the extent of the wound in which it grows, the growth thus differs from a fibrous growth

TREATMENT.—Strong stimulants, applied repeatedly, have some effect in dispersing an *exuberant* cicatrix; apparently by inducing or favoring degeneration and disintegration of the already imperfectly developed fibro-cellular tissue, and thus facilitating its absorption. Iodine and mercurial ointments will perhaps prove the most effectual of applications. *Contraction* of the cicatrix, as after a burn, is preventable than curable. It will be noticed in connection with Burn.

Cheloid cicatrix is removable only by excision, complete extirpation being necessary, and not even then a guarantee of non-recurrence. A recurrent growth of this kind is not more intractable than the original one. When the first removal has failed, I think it better to leave the growth alone; as cheloid often tends to die out.

Plastic operations, planned according to the particular case, are available for the cure either of exuberant or cheloid cicatrix. The general rules for such operations may be thus stated:—That if the scar is to be removed, so as to bring healthy structures together for union in a new place, no portion whatever of its substance should be left; that cicatrix-tissues should not be used for the formation of flaps, or relied upon for any speedy or sound union; that if the scar or part of it is to be included in any flap for sliding or transplanting, all the borders and surfaces of such flap intended for union should, if possible, be of healthy structures, and not themselves parts of the scar; and that flaps should be dependent on scar-tissues for their supplies of blood.

(3.) **Depressed and Adherent Cicatrix.**—As the result of cicatrization in a scrofulous ulcer, especially, the scar is not unfrequently marked by a depression, which is adherent to the subjacent parts. This may be overcome by subcutaneous division with a tenotomy knife.

(4.) **Painful Cicatrix.**—Commonly arising from adhesion of the subjacent nerves to the skin or bone, and not attributable to enlargement of their cut extremities; the cicatrix of any wound may be painful, although most frequently that of a stump after amputation. Usually, the cicatrix-tissue is sound, but the nerves are subject to chronic irritation or inflammation, varying with the mobility and motion of the part. *Neuralgic* pain, of an excruciating and paroxysmal character, is due rather to some constitutional cause affecting a cicatrix, still living in itself. This condition may supervene long after the cicatrix is completely formed, and has loosened from any subjacent adhesions, in the natural course of healing.

TREATMENT.—Free subcutaneous section is almost sure to be remedial, when the pain arises from *adhesion* of the cicatrix. No other pain can only be cured, if at all, by constitutional treatment; chiefly quinine, and careful regulation of the bowels. The topical application of aconitina will often temporarily allay this pain; a grain of the preparation of the alkaloid to a drachm of lard, in the form of an ointment, applied from time to time.

(5.) **Ulceration**, and other morbid changes, *growths* and *degenerations*, affecting cicatrix-tissues, follow the same pathological laws as other structures; and are amenable to the same *treatment*, according

CHAPTER XVI.

BURNS AND SCALDS. LIGHTNING. FROST-BITES.

Burns and Scalds.—Burns are commonly distinguished according to their various degrees of *depth*, from the surface inwards to deeper parts.

Firstly. Erythema, or simple reddening of the skin. Secondly. Vesication, the cuticle being raised in blebs, filled with serum. Thirdly. Incomplete destruction of the skin. Fourthly. Complete destruction of the skin, extending down to and involving the subcutaneous cellular texture. Fifthly. Conversion into eschars of muscles, nerves, vessels, and other soft tissues to within a variable distance from the bone. Sixthly. Charring and complete disorganization of the whole substance of the burnt part.

Superficial burns are most important, and in proportion to the *extent* of surface affected, but not necessarily destroyed. The more superficial the burn, the more the skin alone is affected, if only extensively, the more urgent will be the constitutional disturbance—shock, and the more dangerous is the burn.

Deep burns, when not superficially extensive, are of comparatively subordinate importance; their significance having reference generally to the remote consequences of such burns, by exhaustion from sloughing and suppurative discharge.

CAUSES.—Heat applied to the body is necessarily the cause in all cases; but it may have been either by fire, as by the clothes catching fire, the explosion of gunpowder or other explosive compound; or by means of a hot or scalding fluid, as boiling water or molten lead. The lesions produced in the former way are commonly designated *burns*; in the latter way, *scalds*. This distinction is of practical consequence; burns not unfrequently resulting from the more prolonged application of heat, are deeper lesions, but perhaps of less superficial extent; scalds resulting from the more momentary application of heat, are more superficial, but generally they affect a larger extent of integument. Any *adhesive* fluid, as boiling oil, is a more persistent cause, and boiling perhaps at a *higher temperature* than water, it affects the tissues to a greater depth, as well as superficially. Some such fluids, clinging to the skin, run over a yet greater extent. Thus, then, scalds may be even more severe than burns, by the *duration* of the cause; the amount of lesion, superficially and in depth, being perhaps equal.

Explosive compounds are destructive, not only as causing burns of considerable extent, but also by the mechanical violence of their explosion, producing wounds which might be called *burnt* wounds, contused and lacerated. Grains of gunpowder, grit, mud, or other material may, moreover, be introduced as foreign bodies into such wounds.

SYMPTOMS.—Burns and scalds immediately induce pain and *shock*, both of which are more or less severe according to the superficial extent of lesion. The symptoms of shock, affecting the nervous system and circulation, are the same as those arising from any other injury. But it is accompanied with congestion of *internal organs*; the brain, lungs, and

mucous membrane of the gastro-intestinal canal. The mucous membrane of the pharynx and larynx is extremely liable to be congested, apparently owing to the inhalation of flame or heated air during the accident. The duration of shock is variable, averaging about forty-eight hours—two days.

COURSE AND TERMINATIONS.—(1.) *Shock*, or *Congestion*, proves fatal in many cases within the first *two days*; and indeed, of all the fatal cases of burn, a great majority die in this period.

(2.) *Reaction* and *Inflammation* constitute the next, or second period; extending from the end of the *second day* to the end of the *second week*, during which, probably about half of the cases die—having survived the period of *Shock*, in local burns. The *brain*, *lungs*, and *intestines* are the viscera principally affected; laryngeal cases usually die earlier. The mucous membrane of the gastro-intestinal canal is usually inflamed, and probably *ulcerated*; with, in some cases, evidence of peritonitis. Ulceration of the duodenum is a notable occurrence, in the second period of burn, being found, after death, in about 1 out of every 4 or 5 cases.

The *duodenal ulcer* is sharp-edged, and tolerably circular, as if a portion of the mucous membrane had been cut out; it is very indolent, and usually situated just below the pylorus. Often there are two or three close together. Generally, the burn is on some part of the *chest* or *abdomen*. The earliest known period of duodenal ulceration is the fourth day; on the fifth day, it was noticed in two cases, and in one on the sixth. It usually occurs about the *tenth day*. This ulceration is unaccompanied by general inflammatory symptoms, or by any special symptoms. *Persistent vomiting* and *bloody diarrhoea* are the most reliable. Perforation of the bowel may ensue, and *death* take place suddenly from *hæmorrhage*, or from *acute peritonitis*. In one case, however, after death from other causes, at the end of eight weeks, a recent cicatrix was found in the duodenum.

(3.) *Suppuration* and *Exhaustion*, or *Inflammation* still prevailing, represents the third period; extending from the end of the *second week* to the *termination* of the case. Brain lesions are accidental, being limited to infantile convulsions and pyæmia. The *lungs* or pleuræ are far more frequently congested or inflamed, and this condition is the cause of death. Here, generally, the burn is situated on the chest. The *symptoms*—physical examination being precluded—are sufficiently marked; pain and oppression of breathing, hacking cough, and bloody expectoration. The gastro-intestinal mucous membrane is less frequently congested or inflamed, but ulceration of the duodenum is still not uncommon.

Tetanus, *pyæmia*, *erysipelas*, and other affections may be omitted in estimating the causes of death as from burn; they being, rather, accidental concomitants.

REPARATION.—Burns and scalds heal by the same process of reparation as similar lesions otherwise caused. *Erythema*, produced by a burn or scald, tends to subside, like any other simple cutaneous inflammation; resolution taking place with desquamation of the cuticle. Vesication also is resolved and terminates in like manner. *Deeper* burns involving, successively, the skin, subcellular tissue, and other adjacent textures, are followed by sloughing, with the formation of eschars, abundant suppuration, and then the healing process of granulation and cicatrization. Bat

granulations are exuberant, and the *cicatrix* is *contractile*. At first it is of a purplish colour, and shining, stretched appearance, it immediately begins to contract, and contraction continuing for some months, with great and increasing force, the cicatrix gradually assumes a seamed and puckered appearance; drawing together the surrounding parts, and ultimately producing strange deformity. Thus, remarkable distortions of the face and neck, or of the joints, are produced; and numerous remarkable deformities in all other parts of the body have not unfrequently been met with.

PROGNOSIS.—The chief considerations which determine the prognosis of burns and scalds, are the more or less superficial character of the lesion and its extent, its situation, and the age of the patient. A *superficial and extensive* burn is far more unfavourable than a deeper and limited one. Hence, many scalds are more fatal than burns. These indications, however, have reference to death principally by shock or congestion, in the first period, after burn; or by reaction and inflammation, in the second period. The *depth* of a burn—as compared with a scald—is significant with reference to suppuration and exhaustion, terminating fatally, in the third period. Deep burns are also unpropitious with regard to the part affected; distortion and loss of function supervening.

The *situation* of a burn more especially indicates the probability of visceral congestion. Thus, burns on the chest or abdomen are especially dangerous, in relation to congestion of the lungs or gastro-intestinal mucous membrane, respectively. Burns of the scalp are not so ominous of cerebral congestion; but they are specially unfavourable as regards the facility to erysipelas. *Age* has scarcely any relation specially to the prognosis of burns. Children are peculiarly liable to the danger of (secondary) visceral affections, cerebral, thoracic, and abdominal; and more easily succumb to their influence than adults. Extreme age is, of course, always comparatively unable to resist the shock, and consequences of injury.

TREATMENT.—(1.) *Shock* and the tendency to *Congestion* require immediate attention. Wine, brandy, or ammonia are the stimulants commonly administered to induce reaction. Warm tea may be sufficient, if the patient be young and the burn slight. Laudanum, in favour with some Surgeons, is, I think, undesirable, as being conducive to congestion. The patient should be wrapped in a warm blanket; or immersion in a warm bath has been recommended, which also cleanses the surface of any charred portion of the clothes. (2.) *Reaction*, occasionally excessive, must be moderated by any gentle depletory measures, otherwise than by loss of blood. Mild purgatives, and the withdrawal of stimulants for a time, will generally reduce any undue reaction, as measured by the pulse and heat of the skin. It should ever be remembered that any temporary tendency to *inflammatory* symptoms readily subsides into a congestive tendency, affecting the internal organs. (3.) *Suppuration and exhaustion* are specially inevitable in the course of deeper burns; although some exhaustion supervenes in all burns. The strength of the circulation should therefore be retained for this period, and maintained when it declines. Stimulants are again required, with tonics, and the generous diet suitable in cases of profuse and prolonged suppurative discharge arising from any cause.

Two or three coatings will perhaps be needed which aggravates the burning sensation, so consisting of equal parts of linseed oil and mirably. Lint, dipped in this thick, yellow covering, at once exclusive of atmospheric influence, burns, destroying the cuticle, skin, and exuding surface, are perhaps more advantageous absorbent material. Flour, dredged over encrusting artificial skin. This need not be increasing discharge and separation of the crust by the Surgeon would be attended with the surface about to heal, and would aggravate disturbance. *Carron-oil dressing*, enclosed with be found the best application. If the burn should be dressed at a time; while the rest covered up.

The ulcer formed by the detachment of agreeably to the general directions already Water-dressing, or a weak solution of nitrate appropriate, according to the state of the granular marginal granulations with nitrate of silver be necessary, to repress their exuberant growth. But of all stimulant applications, *boracic acid* powdering the surface with the boracic ery from a burn may assume a healthy appearance.

CONTRACTION OF THE CICATRIX is the greatest or overcome. In anticipation of this event, Distention to position and the application of *extensile* cal contrivances, as soon as the eschar had cicatrization. But any such adjustment of apparatus, will generally prove effectual on contracting when left free, and at length prevent the accompanying deformities.

Billroth recommends *extension*, with continuous pressure on the cicatrix, thus preventing

2. *Removal of the cicatrix* offers the advantage of getting into healthy non-contractile tissue; but the extent of surface, or the part affected, render this kind of operation impracticable. Thus, the cicatrix can be excised, when of limited extent, as in the form of a contracted band.

3. *Destruction* by sloughing may sometimes be resorted to; this mode of removal being effected by means of a *clamp-instrument*, and which is specially eligible when the cicatrix presents in the form of a web, thin, perhaps extensive. In the management of webbed fingers, for example, the clamp is applicable. In aid of either mode of dealing with the cicatrix, *tenotomy* may prove serviceable when tendons are involved.

4. Another method of treatment consists in the *transplantation*, or *sliding*, of a flap of healthy skin into the gap made by division and extension of the cicatrix, or the surface formed by excision.

Skin-grafting, according to the method of M. Reverdin, offers another source—after division of the cicatrix, with extension—when the exposed face has assumed the condition of a healthy granulating ulcer. A *solid* or *exuberant* cicatrix should be dealt with in like manner, with a view to skin-grafting;—by free excision, to provide a healthy granulating wound.

DECREASED CONDITIONS OF THE CICATRIX have received sufficient attention in this work, among Morbid Cicatrices, in general. A *warty* cicatrix observable after burns about the neck and chest, more especially—resembles cheiloid growth, but is remarkable as being the seat of intolerable itching, not relieved by any external application. Large doses of liquor tannæ mitigate this distressing symptom. But, if small and narrow, a cicatrix may be dissected out; if large, it does not admit of removal without risk of considerable hæmorrhage, as the structure, though fibroid, is very vascular.

AMPUTATION is an operative resource unavoidable in certain external cases. Complete destruction, by charring, of the whole substance of a limb leaves no alternative; or, as a secondary operation, it may become advisable under circumstances, locally and constitutionally, analogous to those resulting from other forms of injury.

Lightning produces effects in the direction of its course through the body struck, resembling the appearances of any *ordinary burn*; but the shock may suspend the functions of the nervous system, partially or generally, without any marked appearances of burn, and may thus also kill instantaneously.

A *stroke* of lightning affecting the brain, knocks down the individual with loss of consciousness; lasting from a few minutes to a longer period, in one case an hour and a quarter. Recovery shows that *paralysis* was suddenly produced, partially or completely; and this state may continue for an indefinite period. The *special senses* are variously affected; loss of sight, smell, hearing, and taste; or, more rarely, exaltation or perversion of these functions, have occurred. *Hæmorrhage* from the mouth, nose, or ears sometimes happens; and abortion in some cases.

Every degree of *burn* may be produced, and perhaps in the same person, from the slightest singeing of the hair, reddening or blistering of the skin, to the deepest charring. The course of lightning through the body is sometimes marked by reddish-brown lines on the surface, having starred and radiated appearance. In any case, the clothes are more or

consists in *artificial respiration*, with the circulation.

Frost-bite.—Cold, intense or long, is analogous to those of heat. It may kill the nervous and vascular systems, analogous to the supervention of *gangrenous inflammation*, accompanied with inflammatory reaction. Unlike heat, cold more frequently kills the condition known as "frost-bite."

It is most common on the face, especially on the nose, and on the feet and hands, or the ears and other parts prominent and exposed to cold. But it may occur with impunity may be many degrees below zero. In a cold atmosphere with moisture or the sun, a part exposed thus to a further and sun.

The *symptoms* of frost-bite are loss of sensation in a muscular part; and, the circulation ceases, a pale pallor overspreads the surface, the *stiffness* increasing to hardness, and the part is quite dead.

The *constitutional* disturbance arises from the body to cold, under the circumstances, an overpowering sleepiness, ending in a fainting or even during prolonged exposure to severe cold, the part itself dying with the general system, becomes frozen by more continued exposure, known as "frozen to death."

A part frozen or frost-bitten is not irretrievably lost. It may have become perfectly insensible, as if it were parent like marble, incapable of being revived, but not absolutely dead. How long a frozen part may live is uncertain.

raddling. A tingling or burning pain, and purplish redness, announce returning circulation and tendency to inflammation.

Gangrene having supervened, the separation of the slough should be left to Nature; any unnecessary interference would give a fresh start to the process of destruction, in textures reduced to a slow state of vitality.

Amputation may become necessary, as after a burn; the operation being performed also in point of time and situation, after the formation of the line of demarcation and above it. Yet there may be cases where the apprehension of fatal exhaustion, or of pyæmia, would warrant amputation at an earlier period.

When the *whole body* is benumbed and stiffened from exposure to cold, and life appears extinct, the same gradual restoration should be attempted; by frictions, aided by artificial respiration, in an apartment of moderate temperature. As animation returns, the patient may be wrapped in blankets, and stimulants moderately administered.

CHAPTER XVII.

SURGICAL AFFECTIONS OF THE SKIN, AND SUBCUTANEOUS TEXTURES.

Carbuncle and Boil are alike, essentially, inflammations of the subcutaneous cellular texture, which may occur in various parts of the body; but the effusion is *circumscribed* and brawny, so that the imprisoned cellular tissue invariably sloughs. Certain differences, however, will be observed.

Carbuncle or Anthrax.—Commencing as a hard, vesicular or pustular nodule, this soon enlarges into a *flat*, oval or circular, somewhat spongy swelling, having a brawny circumscribed border; the whole swelling being of a dusky, reddish-brown colour, and painful,—burning, contracting, or throbbing. The *size* of this swelling varies from half a crown to that of a dinner-plate, and it varies also with the progress of the inflammation. At length the skin over the flat surface yields in yellow or ash-coloured sloughs at numerous points, forming as many small apertures, through which a greyish or yellowish, sloughy and purulent, fetid discharge cozes, or starts up on the slightest pressure around; exhibiting a *cribriform* appearance never to be forgotten when once seen, peculiar to carbuncle. As sloughing of the skin advances, the apertures run together and coalesce, the cribriform surface disappears, and discloses the subjacent cellular texture, a quagmire of slough. Carbuncle is commonly *situated* about the shoulders or on the nape of the neck, where if large it gives a remarkable breadth to that part. Occurring sometimes on the lower part of the back or sacrum, it may form on the front of the chest or abdomen, occasionally on either extremity, and very rarely on the forehead or face. Fortunately, carbuncle is usually *solitary*.

Fever of the *typhoid* character precedes and accompanies the swelling, and it becomes more marked as sloughing ensues. But there is also a

ultimately regained, a marked imp
slough was detached. But the bra
and a puckered cicatrix permanent
deepens as well as enlarging superf
beneath, or overwhelming with *pr*
carbuncle situated on the nape of th
a carbuncle subsides suddenly, and
ring apparently from *septicæmia*. C
induce meningitis, attended with de
in three or four days; a case or two
roth's practice.

TREATMENT.—In the *earliest* sta
small pointed vesicle on a hard, bra
often be completely *arrested* by o
interior with a pointed stick of potas
considering the appropriate *curati*
much integument as possible, by th
relief of pain and constitutional distu
the discharge of slough subsequently
fulfils the former indications, an ou
incisions fulfil both. A *crucial* incis
the surrounding induration, as Sir B
mirably. But it is better to thoroug
until a healthy surface is reached.
mann's spoon. Poulticing until the
carbolic, chlorinated, or other antisept
ing to the state of the ulcer, are the

The *constitutional* treatment, me
that of phlegmonous erysipelas. E
opiates to allay pain and procure s
special attention to the state of

il or Furunculus.—In some of its external characters, Boil is with Carbuncle. It is an inflammatory swelling, of a *conical* softening as it matures, but set in a hard base; of a purplish-red and exquisitely painful and sensitive. Its *size* is much more than carbuncle, never perhaps exceeding the smallest swelling kind, about half a crown. Its smaller size and conical shape *gnostic*, even in an early stage. Enlarging slowly, matter forms apex of the cone, tipping it with a yellow colour; this point bursts scloses a subjacent slough or core of cellular texture. But the *rm*, flat surface of carbuncle is never seen,—another diagnostic *ce*. Like carbuncle, a boil is commonly situated where the skin *est*; on the back of the neck, the shoulders, or the buttock, the *eing* a favourite spot of election; occasionally in the armpit, or on *th*. They always seem to choose the most troublesome situations. *ease* the torment, they seldom come singly, but are gregarious or *ve*.

erishness, generally of a more sthenic character than with carbuncle, accompanies the formation of boils.

CAUSES also, so far as they are known, somewhat differ from those of carbuncle. Usually occurring in earlier life, boils are also connected with a *plethoric* state of the system; but they may denote an *enfeebled* system, or they may appear in the sequel of febrile diseases. Their character is often far less explicable. Active exercise by persons of sedentary habits, sea-bathing, the spring-time of the year, or some other influence, will, perhaps, severally suffice to bring out a crop of boils.

TREATMENT is that of carbuncle on a small scale. A *poultice* or fomentation, to promote suppuration and detachment of the matter, should be followed, if the latter does not take place, by a *small incision* for expulsion of the core without any thumbing or squeezing. With water-dressing, the little granulating wound will then heal of itself.

Constitutional measures must have reference either to the plethoric or debilitated state of the system. Alterative mercurials and saline purgatives, followed by liquor potassæ and other alkaline treatment; or iron, and nitro-muriatic acid, the acid-tonic treatment. At the same time, a well-regulated diet, and state of the digestive process, must be overlooked; in weakly patients, the assimilation of nutritious food must be promoted by a course of cod-liver oil.

Chilblain.—This is a local inflammation of the skin, of an asthenic character, sometimes, to regular recurring attacks of congestion. It exists in three degrees:—(1) Simple congestion, with purplish redness, swelling, and great tingling, itching, burning heat or pain; the duration of the symptoms seems to be determined by circumstances affecting the circulation, as exposure of the part to the warmth of a fire, or the cold of winter; (2) periodic character, as the stimulant effects of daily meals. (2) form of vesication; (3) death or sloughing of the affected part of skin, and perhaps of the subcellular tissue, forming an ulcer of a painful character.

The *main* parts of the body are most commonly affected; the feet,

hands, or both; more rarely, the lobes of the ears, or even the end of the nose.

The CAUSES of this affection may be said to be, sudden *variation* of the *external temperature*, and in connection with the predisposition of a *weak circulation*. Hence, chilblain is liable to occur in persons of the leucophlegmatic temperament, or of a scrofulous constitution. *Age* has decidedly some influence; it happens most frequently in young persons or children, and of both sexes; and in adult life more often than in men. This liability generally passes off towards manhood; and chilblains are rarely met with in men over forty years of age, though in weakly women they may recur throughout life. Causes affecting the free circulation in the part, should not be overlooked, such as tight gloves, elastic bracelets and garters, or tight shoes, and sitting posture, long continued, in cold rooms, and with the legs pressed together—as in the mistaken discipline of many a schoolroom.

TREATMENT.—When chilblains are unbroken, the *congestive inflammation* may be brought to resolution, by daily frictions with stimulating embrocations, as of camphor or tincture of iodine, and soap liniment. The old-fashioned remedy, brandy and salt, should not be despised. Intolerable itching sometimes admits of relief by lead-lotion, or calomel ointment. *Vesicated* chilblains may be protected by a coating of collodion and castor-oil varnish. *Ulcerated* chilblain must be treated by poulticing rendered stimulating by admixture with spirits of turpentine, until any slough separates; and then the dressing should be resin ointment, or other topical applications, as for any other indolent ulcer.

Whitlow or Paronychia.—An asthenic inflammation of the fibro-cellular tissue forming the *pulp* of the *finger* or *thumb*; the part becomes acutely painful, tense and hard, swollen so as to give a *club* appearance to the end of the finger, and of a reddish colour. The inflammation and swelling are always *diffuse*—unlike phlegmon; and are also to suppuration and sloughing of the cellular texture, thus attending in its termination. Necrosis of the ungual phalanx is an uncommon event, in prolonged cases.

Whitlow occurs spontaneously in persons of a naturally weak and debilitated constitution, affecting both young and old, and occasionally, it seems to have an epidemic character, appearing in persons without any traumatic cause; and perhaps at certain seasons in the spring. But it arises frequently from some *local irritation*, puncture, scratch, or inoculation with some poisonous matter. It is more frequently met with in connection with certain occupations, as in cooks, washerwomen, and grooms.

Whitlow involving the *sheath of the tendons*, is a more severe affection. It is attended with greater swelling of the *whole finger* to the *hand*, which becomes much puffed and enlarged. *Vesication* in the finger, and *shooting pain* up the *arm*, are soon experienced. The redness is not intense, and the end of the finger, partly encased in the cuticle be thick, and the palm of the hand hardened. The part assumes a dull-white appearance—soddened, perhaps, by the presence of Some inflammation of the *lymphatics*, denoted by red lines in the arm, not unfrequently accompanies this form of whitlow.

feverishness or constitutional disturbances. *Diffuse suppuration* in the *sheath* of the *tendons*, speedily involving the palm, even spread up the forearm, under the annular ligament. The has an elastic character, but distinct fluctuation is obscure. *gangrene* ensues, not only of the cellular texture of the finger and also of the tendons and palmar fascia. *Necrosis* of the phalanges; or a matted state of the part, with a rigid and contracted the finger and perhaps of the palm, rendering the hand useless.

TREATMENT.—An incipient whitlow may sometimes be subdued by prompt employment of repressive measures; by leeching, poulticing, elevated position of the hand. In the *simple* form of whitlow, a incision into the pointed swelling of the pulp of the finger, should at an early period; or even snipping the vesicated summit will at relief. In the *tendinous* form of whitlow, an early and free incision, in the middle line of the finger, must be had to, for the relief of tension and swelling. The digital arteries are thus avoided, and the sheaths of the tendons should not be incised extensively, thus to prevent sloughing and consequent rigidity of the finger. Suppuration or abscess in the palm must also be relieved by incision, observing not to wound the superficial palmar arch, about corresponds with the middle indentation across the skin of the palm. Then well soak the finger and hand in warm water, and cover the whole with a poultice. The nail, growing and elongating, is large; it often loosens, and should then be removed by evulsion with a small pair of sequestrum-forceps, or with Hilton's nail-forceps, which are used more firmly and with less damage to the matrix. As a foreign body the nail would be a source of continued irritation. Any adherent nail need not be removed, but may be pared and scraped to relieve the pain.

A new nail will form, if the matrix be healthy; probably in a period of five or six months before it is completely restored. In the case of whitlow, when the inflammation has subsided, a pasteboard splint will be advisable, to prevent contraction.

Removal of the ungual phalanx necessitates the *extraction* of this dead bone; leaving the pulp end of the finger and nail, which will then form a somewhat hooked extremity, tolerably sensitive and not so unsightly as a truncated end. *Amputation* will be necessary, in the event of more extensive destruction, involving the first phalanx. And it is better to operate rather, apparently, a little higher than too low for the sake of preserving the useless remnant of a nail. Any portion of the thumb, however, will be most useful. The health must be renovated by tonics and diet.

Onychia is a form of ulceration, which commences about the matrix of the finger-nail. It usually arises from a pinch or crush of the finger, or from the *loosening* the *matrix* or loosening the attachment of the nail. After this injury, the finger-end swells, and fluid is effused under the nail, which loses its natural colour, and becomes thin and discoloured at the end, or more rarely curled up laterally. As the nail ceases to grow, it turns upward, and exposes beneath it a very *foul*, and *painful ulcer*; while the *finger-end* becomes *enlarged* and the integument hardened, shining, and of a livid red colour. Infection occurs mostly in children under ten years of age; but is

this purpose, or Dr. Richardson's Water-dressing or carbolic lotion solution, one or two drachms of the of water. Chlorate of potash and treatment.

Syphilitic onychia, as a secondary

Ingrown Toe-nail.—This is especially the working-classes; it m toe-nail, but more frequently on the siderable pain in walking, and gives lations, overspreading and concealing thin, fetid discharge. This conditio overcrowding the toes in a narrow, adjoining integuments over the side of been pared away too deeply at the sid overlap; in either way, the nail gro overhanging fold of integument.

TREATMENT consists in removing hard-toed boot, and then endeavouring nail. The pressure of the integument neatly inserting shreds of oiled cotton-probe or the back of a scalpel-blade. in the course of some days, the nail raised in like manner, until the nail. Scraping the edge of the nail very thin or, by notching the free edge down to grows, may gradually overlap the body. An obstinate or deep ingrowth can only as in the treatment of onychia. A fungoid granulations subside, or they may nitrate of silver or sulphate of zinc.

They are produced by intermittent *pressure* or *friction* on some naturally prominent part, as on the little toe, by wearing a tight, hard boot. Eventually, *beneath* an old corn, a *bursa* is apt to form, which, becoming inflamed from time to time by pressure, greatly aggravates the pain and inconvenience in walking. *Suppuration* is liable to ensue.

TREATMENT.—Relief is obtained by simply removing the cause of pressure—wearing a loose shoe or slipper, or protecting the corn by means of a circular plaster of thick leather, having a hole in the centre over the corn. The common “corn-plasters” are thus used. Pencilling with nitrate of silver induces desquamation, and thus thins down the corn. *Paring* or *scraping* down the corn, previously macerated in warm water, will also ease the pain, as occasion requires. *Extraction* of the centre or core of the corn is the ordinary practice of chiropodists. But the full-grown corn often returns. Inflammation and suppuration must be treated on ordinary principles.

Perforating Ulcer of the Foot.—Under this title has been described a *narrow sinus*, which forms, occasionally, in the foot—rarely in the hand—and which usually extends from the centre of a large corn directly down to bone, the latter becoming exposed and carious. Nélaton describes it as commencing in a *sero-purulent bleb* on a thickened pad of the foot. This, when opened, discloses the subjacent dermis of a rose colour, and highly sensitive; the spot ulcerates downwards into the cellular texture, thus forming a fistulous track, which deepens. Sometimes, the orifice of this sinus is beset with an excrescence or exuberant granulations—like an ulcer; but commonly appearing as a small opening, and with little or no discharge, the part is painless, unless under motion or pressure, and the track is *obstinately indisposed* to close. If closing for a time, it is apt to reopen again. The foot may remain unaltered in appearance, although sometimes it becomes livid and swollen; and it is often bathed with sweat, of an *offensive* nature. These characters of the part affected are associated with a considerable loss of temperature, and of sensibility—the foot, and even the leg, feeling *cold* and *numb*; but usually without any notable loss of motor power. Ultimately, there is some wasting of the leg, and perhaps the supervention of a chronic eczema; thus plainly declaring the *failure of nutrition*.

The chosen seat of perforating ulcer is over the *metatarso-phalangeal* articulation, of the *great toe*, or perhaps of the little toe. Less frequently, it forms on the heel. Commonly *single*, there may be two or three such ulcers on the foot; or both feet may be affected, and symmetrically.

Women are far more subject to the disease than men; and it may be met with in children, seeming sometimes to evince an hereditary tendency.

The causation of this ulcer is primarily referable to pressure, or other injury of the part; but the local malnutrition would indicate a marked predisposition to necrosis of tissue, apparently from *deficient innervation*, vasa-motor and trophic. This is coupled with *anæsthesia*. Thus, the sensory and nutrient fibrils of the supplying nerves are diseased; the motor fibrils being comparatively healthy.

The TREATMENT of perforating ulcer hitherto has proved most unsatisfactory. Gouging out any bone which has become involved, cannot be

very rarely. Similar kinds of out-growths are seen on one of the toe-nails, especially the great toe, which is an inch or two in length, tapering at the point like a horn. This is simply a vertical elevation of the nail.

Excision completely from the base.

Warts or **Verrucæ** are collected together either completely ensheathed by an epidermalium, or with the papillæ isolated, and without a cuticular sheath. They may form in any situation being the *hand* and *fingers*, but are more apparent, or be congenital, or proceed from some source of *local irritation*, as the handling of animal matter, in cooking, or often in children, and in girls who have been through the presence of warts on the face, or unworthy suspicion of such practice. Such vegetations will illustrate the origin of the disease. charge. Such and similar warts are common, warts come and go, sometimes, in an individual.

TREATMENT.—Escharotics may succeed in removing the most obstinate out-growths. The *strong* and *weak* glass brush, or rod, is the most efficacious. The curved scissors, is the only other method. The venereal warts is always free and persistent, and may be stopped by swabbing with perchloride of iron, or light searing with Paquelin's cautery.

MUSCLES AND TENDONS.

CHAPTER XVIII.

SPRAIN.—RUPTURE.—MYOSITIS.—MYALGIA.

Sprains or Strains.—Muscular and tendinous structures are liable to suddenly stretched by violence, without any actual or perceptible laceration of fibre. This lesion commonly takes place in those muscles which are most apt to be brought into action by any sudden and violent exertion, as in running, leaping, dancing, or lifting a weight. Immediate pain and inability to use the part, followed by stiffness, are conclusive symptoms. Any degenerative change, or softening of the structure, will dispose to this kind of injury. It may be succeeded by atrophy and total paralysis.

Treatment.—Rest is necessary for reparation, and this requisite is aided by the renewal of pain from any attempt to use the damaged muscle or tendon. Subsequently, friction and stimulant embrocations are in overcoming the stiffness and removing any remaining thickening.

Rupture of Muscle and Tendon.—This lesion may be regarded only a further degree of Sprain, but it presents certain additional particulars of importance.

The part of the muscle or tendon ruptured is in the muscular substance, or at the junction of the muscle and tendon, in the tendon, or at the junction of the tendon and bone. Occasionally, the sheath of the bone or tendon is ruptured; a protrusion taking place through the rent,—*hernia of muscle*. This more frequently happens in the long head of the biceps muscle, or the extensor tendons of the fingers. The muscles most liable to sprain are also subject to rupture, by sudden and violent exertion. Hence the gastrocnemius, or its tendon; triceps brachii, just above the patella; also the biceps or triceps of the arm, the latter giving way above, in its long head, or below, at its insertion, the latter muscle or its tendon rupturing just above its insertion, into the olecranon. More rarely, the deltoid or the pectoral muscle yields, the ribs abdominis or the muscles of the back are torn.

The symptoms are generally well marked; sudden pain and powerlessness, with a sensation as if something had given way, and perhaps a visible gap. Pain is far less acute if a tendon be the seat of lesion. An interval may be discovered in the situation of rupture, into which a finger will fall when passed over the surface; a hard swelling above and below is also felt, if a muscle be torn, the retracted ends rising up. Subsequently, this state of the part is obscured as inflammatory swelling supervenes, or reparative lymph occupies the interval between the

Reparation ensues, and readily,

Separation of the ruptured ends of the tendon of Achillis, takes place to a very variable extent; in the adult, about half an inch; in an infant, about half an inch drawn upwards by contraction of the muscles, and drawn downwards, according to the position of the foot. The separated ends unite with each other through the medium of a new substance, which remains almost intact, as a tube, and a quantity, is generally effused within the sheath, and lower extremity of the tendon, peritonitis, and blood be in such quantity as to fill the sheath, the surrounding tissues, repair is retarded and the *vascularity* of the sheath marks the commencement of the process; this vascularity extending to the lower extremity and fat. *Reparative lymph* is effused into the sheath, as a matrix, which thus becomes the medium of the infiltration may also spread into the surrounding tissues, obscure the gap in the divided tendon, and form new fibres, through the medium of oval nuclei, which in open wounds, which is developed in the transition forms being found in the early stages of the nucleated lymph would seem to undergo a change from oval nuclei, and their arrangement in a fibrillated, and ultimately a more distinct form. *Secondary blood-vessels* are formed in the connective tissue.

The *divided ends* of the old tendon unite with the new material when the reparative process during its early stages, the connection with the new material when the surfaces are square and sharp edges become rounded, and the substance somewhat softened.

strained or stretched, but divided. These indications are well illustrated by the treatment of rupture of the *tendo-*. The leg is flexed, and the heel drawn up, by means of a band the shoe behind, and fastened to a belt around the lower part h. If the relaxed position be disregarded, the uniting bond sibly be elongated and weak. The newly united muscle or ald be exercised very gradually and cautiously.

ECT AND NON-UNION OF TENDON.—Certain *operations* have sed to induce the repair of an ununited tendon. Paring and joining them by suture will seldom prove satisfactory. us puncture, as for ununited fracture, has proved successful in

cement of Tendon may occur. The tendon of the tibialis uscle occasionally slips out of its groove, or the tendon of the ngus may be dislodged, in either case with instant pain and The long tendon of the biceps flexor cubiti is sometimes tilted roove. Such mishaps generally rectify themselves, the tendon again; or replacement can be readily accomplished by a little n.

t of Muscle.—A *protrusion* of a portion of muscle, through atic sheath, may occur in connection with rupture, involving s of the whole substance of the muscle, and which also opens

This additional injury, therefore, is apt to be produced by from direct contusion, or by powerful muscular action; and ase, perhaps, without any external wound—especially when n forcible contraction. But muscular hernia may also arise ured wound, or gunshot injury.

ture of any such case may be readily discovered, by observing e of a *bulging fulness*, forming a *firm elastic lump*, during of the muscle; and which remaining while the muscle is subsides when it is relaxed. Then also, perhaps, the *aperture* h may be detected by firm pressure with the fingers, and the

uniting with catgut sutures.

Inflammation of Muscle.—In a primary disease, the muscles may be inflamed from adjoining structures. Inflammation of the muscles is probably of this kind in aponeuroses. *Syphilitic* inflammation is said to occur. *Pyæmic* abscesses occur.

Traumatic inflammation may involve the muscle with other tissues.

When myositis subsides, it leaves the muscle weak and powerless, an affection which lasts for some time after the event of suppuration, contraction, and resolution.

The TREATMENT of muscular inflammation is on general principles, having reference to the nature of the disease. Abscess also requires no special notice.

Myalgia—a painful affection of the muscles, often mistaken for myositis; with which, however, it is not commonly arising from a *sprain*, myalgia is commonly arising from a disease of the nerve, or in the course of a nerve, or disease of the system. It may also be symptomatic of a general disease, such as rheumatism, or gonorrhœa, or syphilis, or *blood-conditions*, such as lead-poisoning.

The pain is usually of a neuralgic character, and is not of an inflammatory affection. When the *back* or the *neck* are often the seat of the pain; sometimes the muscles in the *loins* may have been strained,—the one, in giving a blow which misses its aim, or the other, declared chiefly by *pain* in the *movements* of the muscles into action, and which is not relieved by rest.

administration. Spasm may be allayed by sulphuric or chloric and similar remedial agents. As a *chronic* affection, and especially in the case of rheumatic, frictions, stimulant embrocations, and passive motions, restore a painless freedom to muscles which were previously rigid and contracted. It is in such cases that, muscles being relaxed and released in the neighbourhood of joints, the cures of art—so called, are wrought, who claim to have reduced “some extent.” In consequence of chronic myalgia, the muscles often wasted and powerless; and then the *galvanic current* may be of great restorative.

BURSÆ AND SHEATHS OF TENDONS.

CHAPTER XIX.

BURSITIS.—TENO-SYNOVITIS.—GANGLION.

Mucosæ. Synovial Bursæ.—(1.) **Bursitis.**—INFLAMMATION of a bursa may occur, with enlargement and distension of the sac with *secretion*. Suppuration soon follows, and the formation of abscesses which bursts externally or into the surrounding cellular membrane. The bursa is also liable to become involved as the abscess progresses. Ulcerating ulcerations are singularly obstinate.

Chronic enlargement of a bursa, from long-continued pressure rather than inflammation, is another condition of common occurrence. The bursa becomes distended with contents of variable consistency, partly fluid and solid; as an increased sero-synovial secretion, straw-coloured *fluid*, or a brownish fluid, thick and grumous, or a thickly due to altered blood, or adhesive and containing cholesteroline. A matter is sometimes deposited on the interior of the sac, producing considerable *thickening* of the *wall* of the bursa. In the sac, numerous small flattened and elongated bodies may form, resembling *melon-seeds* or parboiled rice; and which result, apparently, from integrated fibrinous matter subjected to motion and attrition, or the detachment of pedunculated fibrinous matter from the interior of the sac. Lastly, fibrinous deposit progressing concentrically, at length convert the bursa into a *solid tumour*, having a laminated structure, or leaving a small central cavity, containing a gelatinous

DIAGNOSTIC CHARACTERS of these varied structural conditions are not so obvious. (1.) Inflammation, followed by suppuration and ulcerating and ulceration, will be severally attended with their

CAUSES.—Some local injury, generally the cause, whether of it or a bursa.

TREATMENT.—(1.) *Inflammatory* fomentations, and topical bleeding, a *free opening* must be made and a free communication is established. Antiseptic solution is used to cleanse an unhealthy cavity. The constitution is supported by the symptoms, now acutely febrile. The enlargement of a bursa yields to variation in the nature of its contents. A bursa may be absorbed by a stimulant, which I prefer. By *puncturing* the injection of iodine, adhesion and introduction of a seton for a few days, contraction.

Fibrinous matter having been deposited and an accumulation of melon-seed tumour must be dissected out—*excise*.

Particular Bursæ.—**Bursa Patellæ.** The patella is liable to the same diseases as the bursa. *Inflammation* and its consequences, unfrequently occur. "Housemaid's knee" is a chronic inflammatory affection of the bursa patellæ, produced by kneeling on a hard surface, and is more common in females and in the elderly. The circumscribed swelling, located over the patella, is distinguished from the characteristic swelling of the distended synovial capsule. This bursa may become an acute abscess.

Caries of the patella—consequently the disease is possibly involving the bone.

trochanter, or of that on the pubic ramus, under the conjoined iliacus tendon, may each be distinguished in like manner, flexion of the hip-joint. 3. In the *foot*, a bursal swelling at the tuberosity of the os calcis, under the tendo-Achillis, is thus distinguished. 4. At the *shoulder*, the bursa beneath the deltoid muscle, circumscribed swelling, apart from the head of the humerus. 5. At the *elbow*, the swellings of bursitis, on the olecranon, and on the biceps tendon, are recognized by their situation, as unconnected with the joint; and beneath the biceps tendon, a bursa—somehow a prolongation of the synovial capsule—may be found enlarged, at the head of the radius, which can be felt with its articulation to be distinct. 6. In relation to the *wrist*, any enlarged bursa over the styloid process—radial or ulnar, is more obviously

III.—Inflammatory enlargement of the *bursa* situated on the dorsal surface of the metatarsal bone of the great toe, or of an adventitious bursa in that situation, is the essential element of a bunion. The cause is an increased quantity of thin serous fluid, or perhaps a dense secretion. Over this enlarged bursa, a corresponding portion of the thickened and horny cuticle—a *large corn*—forms; both of which constitute the bunion. The toe is generally displaced obliquely outwards, and under the adjoining toes; thus forming an angle more or less at the metatarso-phalangeal articulation, or root of the great toe, considerably increasing the prominence inwards. Acute pain, redness, and heat—the symptoms of inflammation—accompany this swelling in the early stage, but it gradually subsides into a tolerably painless enlargement of the bursa; but liable to become acute under irritation. The cause of this condition is the pressure of a *tight and narrow* boot or shoe, habitually worn; whereby the toe gradually becomes displaced from its natural direction, increasing the pressure on the

in the middle, may be applied; the
which is thus relieved from pressure
the usual topical applications; poultice
state of the bunion. *Abscess* formed
made without delay, both to relieve
destruction of the joint.

Chronic bunion is best removed
of *nitrate of silver*. A large, and per-
by an *incision* into the sac, and cautery
of silver or nitric acid. It should be
cates with the joint.

Destruction of the internal lateral
terminate well, by fixing the toe with
ditiion will necessitate *excision* of the

Sheaths of Tendons.—(1.) *Ten-*
—Sheaths of tendons in the neighbor-
inflammation. This is attended with
The *flexor* and *extensor tendons* of the
strains in various laborious occupations
sudden violence, as a wrench, or by
the foot, from over-walking. *Direct*
inflammation; as in the foot, from callus
of a tight shoe. Sometimes the inflamma-
idiopathic.

Puffy swelling and some *pain* in
denote inflammation of their sheaths.
any movement which stretches the
extension will increase the pain of
flexion has the same effect; this denotes
tendons that are strained. A peculiar
sound is elicited on moving the part
true *crepitus* of *fracture*.

on the sheaths may heal, with out-cropping granulations, leaving a hand or foot. But necrosis may yet compel the Surgeon to remove the dead bone, or to amputate the part.

Ganglion.—This is a simple or barren *cyst* or sac, attached to, but communicating with, the *sheath* of a *tendon*; or, forming as a synovial connection with a *joint*, from protrusion of the synovial sac. It is a firm, transparent, whitish, gelatinous matter, resembling the tumour of the eye. The cyst varies in size and shape, from a pin's head to a filbert; and presents a corresponding *tumour*, *smooth*, *elastic*, *subcutaneous*, and *painless*; *situated usually on the back of the foot*, occasionally on the dorsum of the foot.

A simple ganglion does not so much increase in size, as the cyst attains considerable thickness and resistance. Arising from a *sprain*, or as it may be spontaneously—unlike a subcutaneous bursa which proceeds from inflammation—a ganglion is usually of slow growth, but sometimes makes its appearance quite suddenly.

Compound Ganglion is a *dilatation* of the *sheaths* of the *tendons*; consisting of a swelling of an *irregular shape*, and often attaining a *considerable size*, several tendons being implicated in it. The sheaths become inflamed, as well as dilated, and highly vascular, being lined with a red, velvety membrane; the contained fluid is clear and yellowish, or thinner than in simple ganglion; or the fluid may be dark and bloody, in which there are masses of buff-coloured fibrin, or a large number of small or apple-pip bodies, of a semi-translucent, greyish colour, like those found in enlarged bursæ. Movement of the part then produces a *crackling* or *splashing crepitation*,—unlike the dry, jerking rubens of rheumatism or synovitis. Compound ganglion is chiefly met with in the *hand*, and on the dorsum, sole, or inner side of the foot. The progress of the disease is extremely *chronic*, may acquire an almost enormous appearance, and occupy a very extensive surface.

Treatment.—Simple ganglion is usually amenable to remedial measures. In its ordinary situation, on the back of the wrist, a ganglion

the palm of the hand. The sheath containing a glairy or other fluid, beneath the palmar fascia, extends to the forearm, in the form of a double sheath. The fingers are contracted. Various *Subcutaneous* opening, or free incision—the passage of a seton from above the palm, or the injection of iodine—are sometimes resorted to, in the treatment of a condition which cannot be controlled so

NERV

CHAPTE

INJURIES.—NEURITIS.—NEUROSTHENIA.—NERVOUS AFFECT

Injuries.—Nerves are seldom injured, other textures, the injury being shared by them. They are, however, liable to similar lesions, being incised, punctured, and contused, and their continuity is often interrupted. Perhaps the latter lesion of the ulnar nerve at the elbow is the most common. It is caused by catching the nerve in its

of the nerve retract a little, and their extremities, especially the
, enlarge and become more vascular, while coagulable lymph
around and between them. Soon this exudation becomes gradu-
al, and is found to contain cells and nuclei, and then fine *nerve-*
fibres proceed from the extremity of the *centric portion* of the
nerve, that of the peripheral portion, which, on being separated from
the centre, undergoes a gradual atrophy or degeneration. These
new fibres are finer and greyer than those of the centric portion
of the divided nerve, and it is not until after a period of some *months* that
they are fully developed. In the mean time, a *regeneration* of fine
fibres going on in the *peripheral* or atrophied portion of the nerve; but
a long time before these fibres acquire the normal size and con-
sistency. The same kind of reparative process takes place when a portion
of the nerve has been excised, only it requires a longer period."

In the case of nerve-trunks, as the sciatic and median, the original structure
is completely reproduced. When, also, a portion of nerve has been
excised to the extent of, say, the *third of an inch*, the divided ends
reunite, such portion will *not* be reproduced.

The *end* of a nerve—as in an amputation-stump—often enlarges
into a bulb-shaped or *bulbous* extremity, consisting of convoluted nerve-
fibres which grow from the nerve-end, as if to meet an opposite end.
The *end* of a divided nerve is sometimes nodular, in like manner. A
matrix, and especially a bulbous enlargement, is often the seat of
infiltration around, resulting in *compression*, or *adhesion* to the
skin, thus giving rise to various perverted sensations, or the most
characteristic neuralgic pain. This is apt to occur in a stump after amputation.
The patient will, therefore, be guided by these indications of nerve-
power. *Rest* in all cases, and *position* to secure the contact of
the ends of the nerve be divided. Inflammation may be subdued by the
usual means, topical and general. In the event of *bulbous enlargement*,
or *adhesion*, causing intolerable pain, operative interference

the nerve or its sheath should be not to produce an angular displacement. If tendons are brought together. If the ends of the former should be joined thus not to disturb their coaptation a double knot, or simply twisted, and or wire. Metallic sutures may be re

What *length of interval* between being drawn together, can scarcely stretching may be justifiable to a position of the part will further enal contact. Nélaton effected a satisfas was two inches and a half—after event of not being able to find the e if one end cannot be drawn to the o the *ends of two different nerves* ma suggests. When several nerves have nerve which is *functionally* most i upper end of another; *e.g.* the medi above; or, as Letiévant recommends, a small cut surface on an undivided r

The *results* of nerve-sutures are warrant any general conclusions. E less of failure, should be granted, u from the date of operation. Nerve their functions; first, I believe, with their motor power.

Neuritis.—SYMPTOMS.—Inflam neurilemma, is attended with *pain* perhaps remittent, shooting along rendered *intolerable* by *pressure* in th the part. The

ally arising from *injury*, the various lesions to which it induces inflammation, extending along the sheath of the nerve. It thus occurs in connection with wounds, contusions, lacerations, and after operations. *Cold* and *damp* are also, among the exciting causes. 2. But neuritis may also proceed from causes in which it is the local, or one of the local manifestations of a general disease; probably a manifestation of this kind; a *rheumatic* or *gouty* inflammation of the sciatic nerve. And sometimes the disease is credited to *syphilis*.

Local blood-letting and *warm fomentations* are most useful in cases of traumatic origin; while *opiates* or sedatives, as *nitrate of opium*, may procure sleep, or relieve the otherwise distressing symptoms.

Rheumatic neuritis must be treated, locally and generally, as acute or chronic rheumatism. Colchicum and alkalies are administered; or iodide of potassium and bark. In the latter treatment will also be suitable; and when the disease has assumed a *chronic* form. Then also, the pain may be relieved by blistering, or by sedative embrocations, as of opium.

Symptoms, and Diagnosis.—*Pain* is still the prominent feature, as in neuritis. It may be even more severe or more *paroxysmal*; shooting along the course of a nerve, and is commonly relieved by *firm pressure*, although generally increased by the slightest superficial touch or movement of the part. The attack is usually much shorter than neuritis; lasting perhaps a few minutes, although prolonged indefinitely in some cases. Various sensations may be experienced, as creeping, tickling, or burning. *Spasm* of the muscles is a frequent concomitant. Redness, heat, and redness may supervene, and increased secretion, when the nerves of the eye or jaw are affected. But inflammatory character accompanies the attack. The attack of neuralgia, at a certain time in the day, or in certain seasons, is also characteristically distinctive.

In the disease of the part, neuralgia is distinguished by the following *physical signs*—*e.g.* inflammatory swelling, and of the character and disproportionate severity of the pain. It differs in mostly being restricted to one part, and in the absence of general hysterical symptoms.

In the disease of structural disease with neuralgia is sometimes most prominent—and with regard to hysteric pain—the diagnosis is aided by the aggravation of the pain by deep pressure, and by the increased cutaneous sensibility. The mistaking structural disease for neuralgia would mislead the treatment; but this error is not so frequent as the mistaking neuralgic pain for structural disease. In relation to the foregoing points of distinction, the line may be drawn between neuralgia and disease of the joints, the disease of the other parts.

The supra-orbital nerve is more frequently the seat of neuralgic pain. The supra-orbital pair are specially liable; and in particular the supra-orbital pair. In the dental nerves, the pain then being known by the name of *toothache*. But neuralgia may occur in perhaps any part of

localities, or periods of the year, and depressing passions, not unfrequently in previously healthy. 3. Certain blood-poisons are less potent. The malarious poison of the tropics is a source of the most severe and persistent neuralgia. *Rhœa* is another such cause; also albuminuria of the kidneys. *Rheumatism*, *gout*, and *sypilis* are causes of neuralgic victims. 4. The sudden suppression of secretions, as from piles, or of secretions, as in menstruation, are causes of neuralgia. In our search for the causative condition, we must find the immediate and exciting cause. A cause may be elsewhere, *dyspepsia*, the accumulation of feces, or of worms, in the intestinal canal, uterine irritation, eccentric or centric, are causes of neuralgia. A *tumour* in the course of a nerve, or a new growth, sometimes appear to be causes of neuralgia. In some cases, of the nervous system is in this sense caused. In some cases, the cause has been clearly traced in some cases.

TREATMENT.—For the treatment of neuralgia, the following directions can here be given. The cause of the disease should be diligently sought for, in each case. It will be necessary to remove a merely local cause, when the disease is in operation. A change of residence from a malarious to a healthy one may thus be necessary. Medicinal treatment, preventive or curative. Quinine, in small doses, or more—will sometimes ward off the disease. Quinine treatment, continued in smaller doses, will sometimes ward off the disease. And, the same may be said of arsenic. In cases associated with hysteria, the tonic and hygienic treatment, appropriate, will be the same as for that disease. In cases of sulphate in particular, are more effective.

for example, seems only to divert the recurrence of pain to possibly sounder tooth. Sometimes, however, the pain can be connected with a local cause, as in the case of a neuromatous removal is then the only cure. And internal sources of pain have an equally direct influence. Thus, constipation or obstruction of the bowels must be overcome by aperients, chosen on the occasion. Aloetic purgatives, rhubarb, mercurials, and opium are useful, in different cases. *Local applications*, sedative or stimulant, are comparatively useless. Belladonna, opium, aconitina, and other powerful sedatives have been tried in vain. The injection of *morphia*, or of *atropine*, is perhaps more profitable. Brown-Séquard recommends rather large doses; of morphia, two-thirds of a grain; of atropine, from one-sixtieth to one-fifth of a grain. *Galvanism*, by means of the continuous current, may be useful in the pain in otherwise inveterate neuralgic affections. Stimulant embrocations, will rarely be tolerated by the

patient.—(1) NEUROTOMY, OR SECTION of the nerve, is a last resort, and cannot succeed in cases of neuralgic pain depending on pressure in the course of a nerve, unless the occasion of pressure be removed, and the operation be performed above that part. To remove the source of pain, the Surgeon will be guided by an accurate knowledge of nerve distribution, and by pressure-exploration in the course of the nerve presumably affected. The relief afforded by pressure on the nerve going down to the seat of pain, will indicate the action of some other nerve higher up. If pressure can be made above that supposed to be the seat of the pain continues, the inference will be that the cause is really situated; or that the neuralgic affection is of reflex origin, proceeding from a cause in some part perhaps quite remote from the seat of manifestation. In either of these cases, operative interference on the nerve thus affected, will be useless.

In *diffuse cutaneous* or peripheral neuralgia might seem to indicate the propriety of the operation; but amid the numerous anastomoses of nerves affected, it is impossible—by tentative pressure—to define a more limited area, or to trace out some local cause, as the source of the disseminated affection.

If the operation is appropriate, the section must be a *neurectomy*, and not a simple division of a portion of the nerve, the simply divided ends otherwise retaining their continuity.

If the painful affection proceeds from an ascending neuritis, it is possible to observe Dr. Brown-Séquard's suggestions—of examination of nerve excised, to ascertain if it be diseased, and then to operate higher up from the same nerve.

Nerves of all sizes have been subjected to the operations of section. In the upper limb, the ulnar, median, and musculo-spiral have been divided; while, in the lower limb, the external popliteal and sciatic nerves, have been operated on in like manner. Several nerves

a year or two.

Some successful *results* are encountered after respite from torture having thus been obtained, a permanent cure achieved.

(2) NERVE-STRETCHING has more promise of overcoming neuritic or neuralgic pain. When the nerve has been reached by incision, they are pulled by progressive extension, both from the part and the stump. The amount of traction requisite will vary with the size of the nerve. It may be accurately measured by the dynamometer. Eight or ten pounds would suffice for the size—the great sciatic. A sensation of tension and feeling that the nerve is loose is sufficient. When a sufficiently forcible traction has been applied, the nerve is in a state of temporary anæsthesia; and as the pain is relieved—according to Scheving's observations—while peripheral extension produces motor paralysis, necessary, if not injurious, to stretch the nerve. But the limb or part should be immobilized for some time, long, loose loop of nerve might disturb the circulation. Such an extent as to produce permanent damage.

Then, the stretched nerve being again united, the wound in the integument is united. The limb should be used to prevent any contraction from cicatricial tissue.

Nerves in *various parts* have now been operated on. Cords of the brachial plexus, the median nerve, the great sciatic nerves, have been pulled in. Neuralgic pain in stumps after amputation has also been submitted to operation. The results have not been satisfactory.

commonly of a painful character; but which are known only from the locality of the nervous affection, and which is thus symptomatic of the cause in operation. The Surgeon meets with some such case of difficult diagnosis, and requiring careful examination to determine if possible. See Author's "Surgery."

RE.—NEUBOMATOUS TUMOUR.—See MORBID GROWTHS.

Nerves are very rarely the seat of cyst-formation. Only one kind has come under my notice at the Royal Free Hospital, in thirty-six years. It was a cyst, containing a clear gelatinous fluid like that found in a ganglion. The tumour was about the size of a walnut, and growing within the substance of the external nerve—the fasciculi being expanded over it, and indeed forming a sheath, so that the nerve spreading out above and below, became continuous with the cyst. It lay in the nerve, close to the head of the nerve under cover of the peroneus longus. The tumour was removed by excision, involving a portion of the nerve.

—Most commonly appearing as encephaloid cancer, or a tumour, this species of morbid growth may occur in the subcutaneous nerve, and at any part of the nervous system, but more often in the brain. Sometimes, several such tumours are produced; as in the arms and legs. The growth may be either a primary, or secondary formation.

It occasionally including a nerve, cannot be properly regarded as a tumour within its substance. When this accidental connection exists, the nerve perishes in the course of tubercular softening.

ARTERIES.

CHAPTER XXI.

ANEURISM.

—Aneurism may be generally defined to be a collection of blood communicating with an artery, from which it has arisen. A collection of blood may be *circumscribed*, commonly, by enclosure of a portion of the artery, as a sac, forming *true* aneurism; or it may be a *sacculated* dilatation of its external cellular coat alone, or of the internal and middle coats, or possibly the inner coat alone, having a thickened wall—*mixed* aneurism; or, the blood, having escaped from the artery, may become enclosed within condensed cellular texture of the surrounding tissue, forming a sac enclosing blood, external to, but communicating with the artery, and constituting *circumscribed false* aneurism; or the blood

generally between the *internal* and middle coats separated or dissected up by the force of the blood in the given way. Or, the sac may form between the coats of the vessel. The sac thus situated may extend along the vessel.

Signs.—The physical signs of aneurism vary. **TRUE aneurism**—say, of the popliteal artery—*soft, circumscribed* tumour, *pulsating* with an easy touch, to the eye, and to the ear,—as a rasping drum—in unison with each beat of the heart. It is rendered *more perceptible* by *arresting* the current of blood by the finger on the artery, *below* the aneurism. The pulsation and the tumour itself *subsides*, if the current of blood in the aneurismal sac be arrested by compressing the artery above; but on allowing the blood again to flow, the tumour expands—which is rendered very perceptible if the hands are laid flat, one on each side of the aneurism, *uniform distension* being felt to reproduce the position favours the production of bruit—by paring the aneurismal sac; but the pulsating expansion is less perceptible. Aneurism is pendent. And, at this *early period* it is reducible by *pressure*, and the blood thus returned into the artery.

Mixed and circumscribed false aneurism, respectively characterized by any peculiar signs; either of these forms a circumscribed tumour, and in its early stage bears the finger, yet being also reducible.

In the course of time, the aneurismal sac, containing more and more fibrin from the passing stream of blood, becomes *consolidated*. The tumour, as felt externally, is, although still circumscribed; its *pulsations* are faint, and the swelling *cannot be reduced by compression*.

or congested. If the diffused form be consequent on circum-
scription, the individual will have felt something give way
followed immediately by notable enlargement of the aneurismal
sac, accompanied with intense pain, or sometimes a numbing loss of
sensation in the limb, below the aneurism, and faintness. The former
sudden accession of intense pain, is due to tension from the
blood among the textures and possibly under unyielding
latter symptom—faintness, arises partly from shock, by the
sudden stoppage of the circulation, and partly from the loss of blood in circulation, by its
escape. Below the seat of aneurism, the limb assumes the same
appearance as when the aneurism was primarily diffused.
Functional symptoms of aneurism are pain, loss of muscular
power, venous congestion; or there may be special functional dis-
turbance in connection with internal aneurisms. These do not occur
in the late period of aneurism, and do not accompany it throughout

its progress.—(1.) The physical signs of aneurism, already described,
may sometimes be absent; as when consolidation in the sac has taken
place, or when the signs be present, they may arise from other causes,
such as vascular tumours. 1. Such are vascular or erectile tumours, and
aneurisms of a highly vascular character, as encephaloid cancer.
The latter will be determined by comparing the signs of these tumours
with those of aneurism. Thus, an erectile tumour is soft and com-
pressible, and slowly regains its former size when left free. And pulsa-
tion is felt, but indistinctly, or of a throbbing character in the
centre of this tumour, and accompanied with a blowing bruit.
Erectile growth is further characterized by having a bluish or
purple colour. From a consolidated aneurism, the growth is suffi-
ciently distinguished by its erectile character. 2. Encephaloid cancer
of a tumour of soft consistence, and may be so vascular as to
be pulsatile, but it is not compressible. The situation of either

when about to burst externally, having red or purple discolouration of the integument pointing of an abscess.

A *suppurating aneurism* is occasioned by the rupture of an artery into the cavity of an abscess; increased swelling, fluctuation, acute pain, heat, and redness of the skin are the symptoms. The symptoms are partly due to surrounding cells being *communicated* with an artery, by an ulceration of the vessel; thus converting the abscess into an aneurism. A well-known case of pseudo-carotid aneurism, was cured by an abscess, by an error of diagnosis. The aneurismal pain may be distinguished from the pain of an abscess by the presence of physical signs; coupled with the fact that the parts affected in the case of rheumatism are not the same, differential, although less distinctive, than in the case of aneurism.

The history of aneurism will further
If the tumour be circumscribed, by con
there will be the *antecedent* transition c
diffused, by conversion from circumscrib
cedent transition changes from *that* condit
will be the *antecedent* fact of *traumatic* o

Causes.—Aneurism commonly arises from a diseased or atheromatous condition of the artery, which breaks up into oil-particles, with crystals of cholesterol, and undergoes fatty degeneration; affecting the middle of the artery. In the fatty or *atheromatous* stage of the disease the artery presents slightly elevated nodules underneath the thin inner membranous lining. The artery becomes inelastic and brittle, and the intima becomes bony plates, consisting of mineral salts of lime, but having little vitality.

ism as an occasional consequence of arteritis, and when of an acute idiopathic character.

1. *Predisposing Causes* vary in their nature and degree of influence. Age is important, but apparently only as connected with those degenerative changes which the arteries, in common with many other textures, undergo as age approaches. Thus, aneurism is most frequent about the middle period of life, or between the ages of *thirty* and *fifty*; whereas ten years on either side of these ages makes a very favourable difference—under *thirty*, and after *sixty*, the disease being exceedingly rare. 2. Certain *diseases* seem to have some predisposing influence. Syphilis, gout, rheumatism have this reputation. 3. *Climate* appears to possess an appreciable predisposition; aneurism being far more common in cold than in hot countries. The immunity of the East Indies contrasts favourably with the climate of Great Britain and Ireland. 4. *Occupation* has an appreciably important influence, and especially in connection with sedentary habits of life. Thus, any violent exertion, and by persons who are habitually sedentary, is conducive to aneurism. Hunting, pedalling, rowing, and other athletic sports, may therefore have this effect. Such pursuits seem to favour the production of aneurism, by directly exciting a powerful action of the heart and compression of the arteries in muscular exertion. 5. *Sex* is thus associated with predisposing causes; aneurism occurring more frequently in men than women, in the proportion of 8 to 1. The liability of different arteries to aneurism has been shown by Lisfranc to vary in the following order of frequency:—Popliteal artery; femoral, in the groin; carotid; subclavian; axillary; external iliac; brachio-cephalic; brachial, common carotid, equally; gluteal, internal iliac, temporal, equally; ulnar, peroneal, radial, palmar arch, equally.

6. The *External* causes of aneurism relate to *injuries* of various kinds affecting the arteries, as an external wound, a fracture or dislocation of an artery; or, a strain, blow, or bruise, inducing sloughing of the artery. Hence the formation of *traumatic Aneurism*; which is primarily direct, and secondarily only becomes circumscribed, in favourable cases. The spontaneous, and traumatic, origin of Aneurism, may be thus summed up:—

ANEURISM.

Origin.	{ Idiopathic	{ Circumscribed—primarily.
		{ Diffused—secondarily.
	{ Traumatic	{ Diffused—primarily.
		{ Circumscribed—secondarily.

7. The *Effects* of Aneurism are both local and constitutional.

1. *Locally*, *Circumscribed Aneurism* produces *Pressure-effects*. The blood, fluid or semi-solid, pulsating and gradually enlarging, exerts a constant, expansive, and increasing circumferential pressure; producing functional disturbances and alterations of structure in surrounding tissues as exhibited by the pressure-effects of popliteal aneurism. The flow of blood, through the artery, being more and more obstructed, together intercepted, the veins become turgid, and œdema supervenes; this *venous congestion* being increased, perhaps, by direct communication of the large companion veins of the artery, as the aneurismal sac

an area of integument becomes thinned and has a tension can be felt there,—premonitory of what follows. The hæmorrhage, taking place externally or suddenly fatal, or it recurs again and again, and is fatal.

Various special *functional disturbances* may arise from the particular seat of aneurism. Thus, aneurism of the larynx gives rise to aphonia and cough, by pressure on the larynx; or to dyspnœa and dysphagia, when the œsophagus is compressed. With *diffused* Aneurism, the functional disturbances consequent on the circumscribed condition—may be temporarily or permanently. Yet with progress of the diffused tumour, other functional disturbance and organic parts supervene.

(2.) CONSTITUTIONALLY, the influence of Aneurism is more marked. If *circumscribed*, the tumour may induce a febrile or sympathetic fever, arising from the local inflammation; if it is succeeded by exhaustion, from prolonged pain. When the aneurism be *diffused*, the same constitutional disturbance arises. When circumscribed aneurism becomes diffused, this is accompanied, as already stated, by more or less of the same symptoms, both to the sudden and severe pain, and to the hæmorrhage or loss of blood in circulation, the latter being more common in the former, and the former being more common in the latter, or the symptoms of syncope.

Terminations.—Aneurism may undergo rupture, as it is termed; or burst, and eventually give rise to hæmorrhage, externally, internally, or in the blood. It may, however, result from *functional disturbance* involving some important organ; as in aortic, aortic aneurisms. Less common modes of death occur, from pressure on the heart or lungs, or from transmission of blood-clot.

tends to restore this resisting strength, and is therefore conducive to the cure of aneurism. The *details* of this effly these:—The blood continuing to flow through the *sac* upon the interior of the sac a thin layer of coagulum, another is superimposed, and so on, forming a concentric *coagulum*; the outermost portion of which, attached to the sac, *acquires* considerable firmness and resisting strength. This consists of *organized* fibrin. It eventually becomes somewhat friable, and *changes* in colour. The portion of coagulum next in order of *development* and appearance of damson cheese; while the innermost contact with the flowing blood, is semi-fluid, like currant *jam*, termed or *stratified* and decolourized fibrin is called *active*, *or*, *passive* clot-formation. By this successive deposition of *coagulum* the sac is gradually filled up to the level of the artery, which *eventually* the surface of coagulum exposed to the current of *blood* has a smooth and membranous appearance. (a.) In a *large* artery, *the* the blood flows with most force, coagulation within the *aneurism* is the whole extent of spontaneous cure. Its external *appearance* gradual solidification of the aneurism; less and less forcible *pulsation* becomes that of a solid tumour; and, lastly, the *pulsation* can be reduced by pressure applied to the artery above, or *below* the aneurism. (b.) In aneurism of an artery of the *second* *degree*, through which the current of blood flows less forcibly, *blood* advances from the sac into the vessel, which gradually be- *comes* filled up, above and below, with a coagulum, extending to the *artery* the branch above and below the aneurism. This advance of *coagulum* is accompanied with the cessation of pulsation. Eventually *the* coagulum contracts and dwindles into a comparatively *small* solid *mass* the artery, to some extent, *above* and *below* it, is con- *tinued* an *impervious* fibrous cord. During this process of obliteration *of the artery* has been gradually made for the loss of the original *artery* closed through the artery. The collateral branches above the *aneurism* portion of artery enlarge with the additional flow of blood *into the artery*, and becoming equal to their extra duty, at length convey as *much* more, blood than the aneurismal artery formerly supplied. *Artery* is adequately restored, and nutrition efficiently sustained, *and* sensory supply of blood—the *collateral* circulation.

ANEURISMAL DILATATION of the *whole circumference* of an artery—*Tubular* Aneurism—the cure by coagulation is just possible, *and* the *artery* is left free, for the transmission of blood.

CHRONIC Aneurism, when it remains in this condition, runs the *course* indicated by its operation as an internal cause of local and *systemic* disturbances. The tumour progressively enlarging even to *large* size, and ultimately bursting, externally, internally, or in *various* ways, the career of such aneurism tends inevitably to further *hemorrhage*.

TREATMENT.—Remedial measures—hygienic, medicinal, and operative *are* entirely responsive to the natural or spontaneous cure of

ARTERIAL Aneurism. The mode in which natural cure takes place is by *retardation* of blood through the aneurismal artery, sufficiently

sufficient for this purpose, and applied *intermittently* for, will represent the kind and amount of assistance necessary—complete occlusion and by continuous pressure, which obliteration of the artery. More recently, under the influence, the requisite degree and duration of compression defined—or “rapid” pressure effected—in cases where this method would not otherwise have been tolerated.

Compression.—Various forms of Instruments have been pressing an artery, above the seat of aneurism. The *compressor* may be in the shape of the horse-shoe or Signoroni's tourniquet, invented by Carte, the advantage of which is that it provides yielding pressure, instead of the unyielding force of the screw-compressor is constructed on the same principle, the pressure maintained by a truss-spring. Other forms of instrument are used: Hoey's clamp; and Dr. P. H. Watson's weight-force. In applying any compressor, the *limb* should be evenly vented congestion of the vessels, as much as possible; and cushioned by the pad of the instrument may be much saving and powdering the integuments of the part. Two compressors are often applied in different parts, alternately, in order to insure the same situation. Thus, for the treatment of aneurism, a compressor in the groin, and another in the middle of the thigh may be alternately tightened and relaxed, as the pressure is to bear. But in transferring the seat of operation from one to another—from the common to the superficial femoral, the position is also altered,—a disadvantage compared with the “direct pressure,” to which Mr. Walker, of Liverpool, has attracted attention. The total *duration* of intermittent compression is determined by its effect in promoting coagulation and the tumour; the period necessary for this purpose varying in a few days to some months.

Compression, or pressure with the fingers, may be conveniently employed in situations *ineligible* for *instrumental compression*. In those of the axillary, subclavian, and carotid arteries. In the case of the carotid, pressure with the fingers on the cardiac portion of the artery, will aid the natural process of cure by retarding the flow through the sac. The requisite continuance of compression may be maintained by having a sufficient number of assistants; each, in turn, applying the vessel before the previous one withdraws his finger, so as to apply only that degree of pressure which controls the aneurism. In some situations, where the artery lies in the third part of the subclavian, pressure may be effected by a hammer furnished with a spring pad. A quarter of an hour or half an hour will be about the time each assistant can maintain the pressure without fatigue, but by the addition of a third or fourth on the finger, steady pressure may be continued for a longer time.

Having maintained compression, in this way, for a few minutes it may be advantageously allowed a period of intermission by its reapplication, and so on alternately. The total number of periods necessary to complete the cure, varies of course

Esmarch's bandage and elastic coil.— would seem to be a combination of means to direct and collateral, with relation to the an or passive clot-formation may occur, rather of laminated fibrin. *Small-sized aneurisms*, suitable for the trial of compression in this w cable only to external aneurisms in eligible

(2.) **LIGATURE.**—Ligature of the aneurysm is not made on the side, but at *some distance* from the sac, and This is the Hunterian operation for Aneurism. The ligature is placed on any part of an aneurismal artery, the artery below the ligature separates; thus permanently interdicts the blood through the artery, itself perhaps a main artery. It therefore, should be an ulterior resource to the operation of compression; obliteration of the vessel not becoming necessary. It is therefore, preceded by hygienic (or preventive) measures—retarding the general circulation—has failed.

Then, if the heart be competent to withstand the circulation consequent on the operation, and complicate the case,—under these favourable conditions the aneurismal artery, by ligature, is a justified

There are, however, certain *unfavourable* indicating, circumstances with respect to this matous or calcareous degeneration of the artery would be a decidedly adverse condition. But prior to operation. A *rapidly enlarging* an evincing an indisposition to the deposition again, a *very large aneurism* is unpropitious the limb; an event almost inevitable, if the cut off by ligaturing the artery. *Inflammation* favourable, by possibly proceeding to suppuration would be a positively *feebly*

yet without cutting off the supply of blood entirely. A sufficient quantity is transmitted for the process of coagulation, by *collateral branches* issuing from the artery above the ligature and communicating with the *vessel below*, but *above* the aneurismal sac; while there is also a sufficient quantity of blood transmitted onwards, and by collateral branches which become adequately enlarged, for the maintenance of the *limb below*. Meanwhile, coagulation and the deposition of laminated fibrin is proceeding in the aneurismal sac, which thus becomes consolidated; the ligature separates, in the usual manner, by sloughing of the ring of artery within the noose, and the divided ends of the vessel are simultaneously sealed with plastic lymph. This takes place in a period ranging from ten days to a month; but varying chiefly according to the size of the artery, and the plastic power of the individual. Finally, the consolidated aneurism and dilated artery are partially absorbed, so that the latter withers and degenerates into a fibrous cord. The limb, nourished by the collateral circulation, may nevertheless become somewhat atrophied.

Signs after Ligature, by Hunter's Operation.—Certain alterations in the signs of aneurism attend or follow the Hunterian operation of ligature. The aneurism *ceases to pulsate* and *partially subsides*. These changes taking place immediately the ligature is drawn tight, are valuable signs of its successful application. The circulation of blood being proportionately arrested in the *limb*, it becomes *numb and cold*, and its *muscular power* is diminished. But, usually, near the seat of ligature, the part is perceptibly warmer, and moistened with perspiration. As the *collateral circulation* is established, these immediate effects disappear; the temperature of the whole limb may rise above that of the other, a tingling sensation is experienced—formication, as if insects were crawling within the flesh, and the sense of weakness is only that of heaviness. The aneurismal tumour, in the course of twenty-four hours, continues to diminish, but acquires a hard, elastic tension, and is perhaps slightly *pulsatile*; returning, however, to a passive state, as the tumour undergoes absorption, and gradually disappears.

After-treatment.—The treatment after this operation should be directed to avert the temporary tendency to *gangrene*, pending the establishment of an adequate collateral circulation. Hence, the circulation and temperature of the limb must be maintained. A thick wrapper of carded wool answers most effectually, aided by a suitable elevation of the limb to relieve congestion. The diet should be moderately nourishing and stimulant, which, with the judicious administration of opium, will tend to sustain the process of cure.

CONSEQUENCES.—Certain *unfavourable consequences* and *evil results* are liable to ensue from this application of the ligature for aneurism.

(1.) *Pulsation may continue or return* in the aneurismal sac. The small stream of blood conveyed by collateral branches into the artery below the ligature, and thence into the sac, depositing the laminated fibrin, is not a pulsatory current. If, however, these *feeding vessels* are larger than sufficient for this purpose, pulsation continues, or soon returns; if they enlarge immoderately, then also pulsation returns in a month or six weeks. *Rarer causes* are these:—Any condition of the blood which, delaying or hindering coagulation, disposes it to remain fluid in the sac, will favour the continuance of pulsation. A *vas aberrans* may

absorption, is a very uncommon
ligature. This must not be confused
after ligature, an aneurism close
pulsation, in consequence of a
portion of the artery. Second
distinct aneurism arising close
fact—is quite another matter.

Treatment of Pulsation, &c.
must have reference to the cause
in most instances, from an undecayed
directly or indirectly, with the
deposition of laminated fibrin per-
cure rights itself. Failing this re-
of fibrin and the supply of blood
sufficiently *elevating* the *limb*;
strained by moderate pressure of
roller, evenly applied. 2. The pro-
the time of operation, by ascertaining
trols the pulsation of the aneurism
sought. It will not be far off, and
In like manner, the aneurismal artery
of the sac, when the supposed aneurism
this should be done *before* the ligature
of the ligature *transversely* round
pulsation continuing or returning,

Extreme cases, which baffle
necessitate further operative procedure
may have to be resorted to; either
as an approach to Anel's operation
the clots, and tying the artery in
operation of Antell.

ure of the sac, this source of obstruction can be removed by
tion of cutting down upon the sac, laying it freely open, and
the clot. 2. Other preventive measures, topical, dietetic, and
ave already been noticed in reference to the appropriate treat-
gature. With gangrene, as with recurring pulsation, *ampu-*
e limb is our last resource; and the operation must be
bove the situation of the ligature.

Suppuration and sloughing of the sac is attended with the usual
f inflammation—heat, pain, and throbbing. At length the
give way, purulent matter is discharged, and portions of clot
g various degrees of consistence and shades of blood-red
en hæmorrhage of fluid arterial blood occurs, either with a
r recurring in small but increasing quantities.

ss commencing *external* to the sac, and opening into it, runs
urse; or suppuration may begin, both in the sac and the
are around, afterwards forming one abscess.

es of suppuration and sloughing of the sac, and of hæmor-
e arising, in the course of aneurism, are any conditions un-
o the *vitality* of the *sac*. Hence, the large and increasing
neurism, and the imperfect coagulating power of the blood
e this tendency. So also any external injury to, or irritation

The average time is, perhaps, between the third and eighth
in a case of carotid aneurism, suppuration occurred at the
h after operation. Comparatively few cases terminate fatally;
more than one in four, and then, generally, by hæmorrhage.

St.—In the first instance, the sac should be treated as an
cess; only that when an *incision* is made, it should be free
urn out the whole of the clot. Any remaining portion of
likely to putrify and become a fetid, purulent discharge; but
ed entirely, the sac is in a condition to heal from the bottom
ion. *Hæmorrhage*, of course, is imminent. A tourniquet,

wait and see what Nature can accomplish, as the healing pro granulation closes over the arterial aperture in the sac; guarded by the *compress*, and during its reapplication occasionally, by tight the *tourniquet*.

This faithful following up of Nature's operation having failed, our resource is *amputation*.

(5.) *Secondary hæmorrhage* from the *operation-wound*, after ligature by the Hunterian method, is an event unconnected with the cause of Aneurism. It is a failure of the operation; and, as it arises from slippage of the included portion of artery before the preparatory closure of the vessel at both ends of the vessel has taken place, the hæmorrhage occurs ever the ligature separates. The average time is the eighteenth day after the ligature of the femoral artery. It is more likely to occur, the nearer the artery is to the heart, the central force of the circulation.

The *treatment* in this case is not presumed to be restricted by the diseased state of the artery, at the seat of ligature. 1. Consequently the reapplication of *two* ligatures, one to each end of the artery at the point of division, will most probably prove effectual; the former operation-wound having been sufficiently reopened for this purpose. Temporarily the hæmorrhage may be arrested or checked by plugging with arable lint. 2. In the event of double ligature, *in situ*, having failed, a second ligature of the main trunk—*higher up*, must be resorted to. But this may prove ineffectual; either by regurgitation from the distal end of the vessel, in the lower operation-wound, or from even the higher failing to command the source of the hæmorrhage, owing to an origin of the bleeding artery. The possibility, at least, of a supervening is, however, the chief risk to be encountered; and therefore, be inclined to try *compression* of the main trunk, before recourse to ligature of that vessel. *Amputation* is, of course, a resource in any case; but this procedure would be more judiciously risking any probability of gangrene, for then the limb must be amputated under more adverse circumstances.

OBLITERATION OF AN ARTERY WITHOUT DIVISION.—Since the time of John Hunter, whose method of operation, on the femoral artery, in the cure of popliteal aneurism, *originally* consisted in the compression of a ligature or ligatures, without any division of the common vessel, this principle of treatment has, from time to time, attracted attention; the object being the consequent preservation of the continuity of the artery, thus to prevent the risk of secondary hæmorrhage. Various procedures and contrivances have been devised for this purpose. *Temporary compression* of the exposed artery, as by means of a *compressor*, Crampton's *presse-artère*, or Porter's wire-compressor, by Stokes, an instrument whereby acupressure is effected; or, as has been used, but made of silver wire, or consisting of some other substance, such as chamois leather, introduced by Dr. Physick, of Philadelphia; buck-skin thread, employed by Dr. Jamieson, of Edinburgh; or moistened catgut, which was the material, as first suggested by Sir A. Cooper, and subsequently preferred in Porta's practice. The ligatures are cut off short, and left in the wound, which heals over any such ligature is better tolerated as a foreign body, and it may become absorbed, leaving the external coat of the artery undivided.

the vessel obliterated. *Carbolized* catgut seems to answer even better; the wound almost always healing by primary union, and burying the ligature. Recently, *chromicized* catgut has found favour, as a more reliable ligature. Arteries of the largest size, as the common iliac, external iliac, femoral, common carotid, and brachial arteries, have been ligated with animal ligatures.

COMPRESSION, or LIGATURE, of the *distal* portion of an aneurismal artery represents other methods of imitating another mode of natural cure; although the obstruction, as thus effected, is not by the impaction of a piece of clot in that portion of the vessel. Whether the arterial current be obstructed by ligature, or simply by compression of the artery, at that part of its course, in either case the principle is to retard the stream of blood *through the aneurism*, and thus induce the deposition of laminated fibrin with consolidation of the sac. For this purpose, it is necessary that there shall be no arterial branch between the aneurismal sac and the ligature, which would lessen the obstruction offered to the current of blood on the distal side of the sac. *Carotid* aneurism alone fulfils this requisite condition for the success of distal ligature or compression.

The immediate effect of distal obstruction is to turn the full force of the arterial current into the sac; which being distended, may at once burst and burst with *fatal hæmorrhage*. Should this issue not occur, the collateral branches of artery from the main trunk above the aneurism, will probably have time to enlarge sufficiently to relieve the tension of the sac, and to carry on the circulation for the maintenance of the limb; a small feeding stream of blood passing down also to the sac, which becomes solidified and obliterated by the process of natural cure. But this happy issue is very precarious and doubtful.

GALVANO-PUNCTURE has been practised for the purpose of inducing coagulation of the blood, *en masse*, within the sac. Two needles, insulated by gutta-percha coating, and connected with the wires of a galvanic battery, are introduced into the sac, in opposite directions, until they nearly touch, and fibrin becomes deposited around one of the poles, or needles. The action of the battery should be continued for about ten minutes, and repeated several times.

Under this galvanic influence, a soft clot may form which partially fills the sac; but acting as a nucleus it may induce the deposition of laminated fibrin, and at length occupy the whole sac. Or, a large but loose clot having formed, in the first instance, it may settle down, and thus the sac become consolidated. Or lastly, the current of electricity excites inflammation of the sac, rather than coagulation of its contents; and this may be followed by coagulation, or by suppuration with sloughing of the sac and its obliteration. These are successful issues. But there are cases, and not a few, of an opposite kind. The *clot liquifies*, pulsation is re-established, and the disease resumes its course. This relapse, after galvano-puncture, is probably due to the mode of coagulation thereby effected; the mass of blood setting suddenly into a semi-solid state, instead of consolidating by the gradual deposition of laminated fibrin. Then again, in the event of inflammation supervening, sloughing is mostly accompanied with *hæmorrhage* which may be fatal to the patient's limb or life. Apart from any adverse issue, the *pain* occasioned

1000 of a pint of the blood in
The safest instrument for inj
with a screw-piston, and a fine
This instrument may be gradu
fluid injected by means of a
answers the purpose more exact
a minim of the solution. *Be*
the artery should be suspended
either side of the aneurism. Th
larly into the aneurism, until a
shows that it has penetrated. T
points within the sac, and a dro
as many *centres of coagulation*.
of the piston, backwards, will pr
the integument.

Taking all these precaution
solution, and its injection into t
consolidation and cure. But the
inflammation be excited into the
character of the solution, will pr
ing, with fatal *hæmorrhage*, or t
ments, may end in *gangrene* of t

Various substances have be
purpose of *mechanically* inducin
passes through the sac,—just as
whipping blood in a basin, with
catgut, and horsehair have been t
with the same risk—*inflammatio*

Ergotin has been injected b
view of exciting *contraction* of th
was used,—from one to three gra
and glycerine. Th

would leave a useless limb—after other treatment; *e.g.* the destruction of the knee-joint from popliteal aneurism; (c) the co-existence of an internal aneurism with an external one—say, of the popliteal artery—would afford sufficient evidence of a general degeneration of the arterial system.

The question of *secondary* amputation—after other treatment for aneurism, was considered in connection with the consequences of Ligature.

Treatment of Traumatic Aneurism.—In the first instance, traumatic aneurism is always a *diffused* and more or less pulsating collection of blood, *communicating* with an artery; this escape of blood having taken place, by a puncture or laceration, more or less complete, of the vessel; and with, or without, an external wound of the integuments. Hence, a punctured wound, or division, of an artery may give rise to traumatic aneurism; or this lesion may be produced by contusion, a wrench, a fracture or dislocation, involving an artery. Such being the essential condition of traumatic aneurism, if the tumour be also enlarging, if it be *diffused* and *diffusing*, the immediate and total arrest of the hæmorrhage is necessary.

Ligature of the artery above and below its wounded point is the treatment indicated. A free incision into the tumour will expose the half-coagulated blood and commingled textures, when the mass can be readily turned out; the recurrence of hæmorrhage during this procedure being guarded against, by an assistant compressing the artery on its cardiac side, and as near the tumour as is practicable. Having sponged the bottom of the cavity thus made, the bleeding orifice may be seen at once, or it will be discovered by a spirt of blood, when compression on the artery above is slightly, and momentarily, relaxed. The vessel must then be secured, by tying it on either side of the aperture; or if divided, by tying both ends. Failing to effectually control the hæmorrhage, plugging of the cavity, from the bleeding aperture outwards, will be necessary to completely arrest it. And this additional safeguard is unobjectionable, as the wound can only heal, for the most part, by granulating from the bottom.

If a traumatic aneurism has become *circumscribed*, thereby evincing a decided tendency to natural cure, then *compression* of the artery *above* the aneurism, or perhaps *direct* compression; and *ligature* on the *cardiac* side only, and at *some distance* from the tumour—*i.e.* the Hunterian operation—are both eligible resources. If the circumscribed aneurism be of *small* size, compression alone may prove sufficient to retard the passage of blood; or that failing, the Hunterian operation will probably be an effectual check. Thus, in the palm of the hand, where it would be difficult and hazardous to apply a ligature on either side of an aneurismal tumour, the brachial artery has been ligatured for a small circumscribed traumatic aneurism over the ball of the thumb, and cure was accomplished.

The application of a ligature, still on the cardiac side alone, but *near* the aneurism, is not forbidden by any structural condition of the artery. This procedure—Anel's operation—is appropriate, provided only that the force of the circulation through the aneurism can thus be sufficiently retarded. But if the aneurism be, or become, of *large* size, although circumscribed, the force of the current preponderates over the arterial resistance, and the balance cannot be sufficiently restored by a ligature at any

named from the varicose condition thence communicates. But the vein

SIGNS.—The same signs accompany are very significant.

1. Take, for example, a common median basilic vein, occasioned by these vessels are punctured, as the superficial aperture in the vein at the deeper aperture in the vein at the current of arterial blood, being is less forcible below the seat of injury wrist to a *feeble thread*; and as the median basilic vein into the *veins* of *distended* and *tortuous*, or varicose. assumes an eel-like appearance down basilic and median cephalic, the radial and cephalic veins at the bend of degrees the force of the arterial current varicose. And these veins, with or without *pulsate* in unison with the arterial pulse visible, perceptible also as a tremulous sound. Moreover, the whole *swelling* in the course of the veins, or it *subsides* when *pressure* is made on the *artery*. will have the same effect.

2. In the event of a *circumscribed* the aperture in the artery and the swelling is at first *soft* and *compressible* elastic consistence, by the gradual decrease within the sac. If allowed to progress tint of venous obstruction, by

by aneurism occasionally into a neighbouring vein. The cause of Aneurismal Varix simply, or the formation of Varix, has reference to the anatomical relation of the artery and vein. If the two vessels are in *contact*, a *direct* communication is established—giving rise to Aneurismal Varix; whenever the vessels are in *contact* or in *apposition*, an *indirect* communication is established—formation of an *intervening circumscribed false aneurism*—*Varicose Aneurism*. The latter is an additional condition. In respect to the thigh, the ham, the neck, the arm, and in the foot, there are cases recorded.

AND CONSEQUENCES.—Whether simply as Aneurismal Varix, or as Aneurism, the vascular condition may remain *stationary*. There are cases of varix on record, which remained without interference for fourteen, twenty, and thirty-five years. But the *tendency* is to *gangrene* of the limb or part below the seat of the communication between the artery and vein.

PREVENTION.—The *prevention* of any further enlargement of the small enlarged and tortuous veins should be the first consideration. A *compress* should be applied over the aperture of communication between the artery and vein, with an *elastic bandage* to support the vessel at the aperture.

In some cases, aneurismal varix undergoes *progressive enlargement*, attaining such a size as to endanger the limb by gangrene, or to shorten its life by hæmorrhage. Then, the operation by *double ligature* of the artery, on either side of the aperture, is the only safeguard; or a punctured wound of the vessel.

When *Varicose Aneurism* having formed, this indication of the more imperative. Gangrene and hæmorrhage are both more likely to occur than in aneurismal varix.

—Whenever practicable, the limb should be emptied of blood, the circulation arrested, by means of Esmarch's elastic bandage, or by the use of the tourniquet. In performing the operation for double ligature, the first incision is made through the skin, and which lays open the venous pouch, brings it into a cavity, at the bottom of which an aperture is seen. But this aperture is for ligature; it leads into another cavity, the intermuscular space, which must now, in its turn, be laid open, at the bottom of which is another aperture, opposite to the former one; and that leading into the artery, is the one, on either side of which the vessel is to be secured. The application of the ligature is often a problem of some difficulty also; owing to the dilatation of the artery on the one side, and its equally contracted state below the aneurismal

enlargement. In the face of the difficulties of this apparently simple operation, it has been recommended, by Roux and Fergusson, to apply the ligatures without incision.

—The objection to double ligature is the risk that, in curing the lesion of the artery, hæmorrhage will more probably supervene than when the vessel is left to take its natural course.

—Other modes of treatment have been practised with less success. Thus, the use of the cautery has proved effectual; and also perchloride of iron *injection*.

excepting with reference to three portions

DIAGNOSIS.—(1.) *The anterior aspect of* may be felt in the intercostal spaces to resemble perhaps the cardiac impulse, but beat of the heart. As the aneurism increases externally,—perforating the *sternum*

(2.) *The summit of the arch.*—A pulsation at the *episternal notch*, and rising into the neck simulate aneurism of the innominate artery. But the tumour is continued downwards with dulness on percussion and a bellows heard there.

(3.) *The posterior wall of the descending* appears *posteriorly*, near the spine or beneath the left side, and enlarges to a considerable size.

Apart from these three situations of aneurism of the aorta—as, for example, within the cavity of the aorta—are so placed with relation to the heart, that an aneurism proves fatal before any pulsating tumour is perceptible.

PRESSURE-EFFECTS vary with the position of the aneurism in its relation to surrounding parts, and according to the size.

(1.) At the *root of the aorta*, and particularly at the *base of the heart*, an aneurism can scarcely attain an appreciable size without rupturing into the pericardium.

(2.) At the *termination of the arch*, or at the *junction of the arch with the descending aorta*, it often increases to a large size without a rupture. *Dysphagia* is, however, the special symptom which immediately attends the right of the tumour.

(3.) In the *concavity of the arch*, aneurism increases slowly in its progress; notably, the bifurcation of the arch into the right or left, according to the inclining direction of the tumour.

with special symptoms; *cerebral disturbances*, owing to interruption of the circulation through the carotid arteries.

(6.) On the *anterior aspect of the arch*, aneurism is less productive of pressure-effects than in any other part; *oedema*, only, slowly supervening by compression of the innominate veins.

Pain is a symptom common to all these aneurisms, as it is to aneurism in general. While, therefore, it cannot be reckoned a special symptom, its character is in some respects peculiar. The pain may be piercing and intermittent or neuralgic; arising from pressure on the nerves—spinal or sympathetic. Affecting principally the left side, it darts up the side of the head and face, radiating down the arm to the elbow, through the chest, or shooting to the scapula. Or the pain may be grinding, burning, and continuous; owing to excavation of the tissues and bones. This kind of pain affects chiefly the right side of the chest. In every case, pain is a very early symptom, as compared with symptoms more special and characteristic.

TREATMENT.—1. Commencing with the *internal method of treatment*, thoracic aneurism, in any portion of the arch, is more generally amenable to rest and restricted diet, than aneurism situated elsewhere. Some amount of consolidation may thus be effected, and life prolonged. 2. The next resource deserving of trial is *galvano-puncture*, by means of Ponceau's battery with insulated needles. The risks of this procedure are not more than in relation to other aneurisms, and it has afforded some encouraging results. 3. *Tracheotomy* may become justifiable, for the relief of urgent dyspnoea; but, as Professor Spence observes, only when dependent on laryngeal spasm from pressure of the aneurismal tumour on the recurrent laryngeal nerve; when the urgency is due to pressure on the trachea, and necessarily below the seat of operation, such interference would be useless for affording even temporary relief. The proximity of the sac must be remembered, in using the knife or in entering the tube. *Laryngotomy* will, therefore, be the safer operation in most cases.

Aneurisms at the Root of the Neck.—They are aneurisms of (1) the *innominate artery*, and (2) of the *commencement of the right common carotid and subclavian arteries*, respectively. Aneurism of the *thoracic portion of the left common carotid or subclavian arteries* is unknown.

In the **DIAGNOSIS** of aneurisms at the root of the neck, on the *right side*, the special symptoms of aneurisms of the aortic arch must be duly considered; but the difficulty will be to determine which of the three arteries is the seat of aneurism.

The rules, as laid down by Mr. Wardrop, are as follows:—Aneurism at the root of the *carotid artery* presents itself first in the small triangular space between the *heads* of the sterno-mastoid muscle. Aneurism of the *subclavian* presents on the outer or *cervical side*; and of the *innominate*, on the inner or *tracheal side* of that muscle. Then again, the *pulse* in the radial or brachial artery, or in the carotid or temporal, is less on the aneurismal side of the body. Diminished pulsation in the neck may indicate aneurism of the carotid trunk; in the arm, that of the subclavian; while diminished pulsation in both situations may indicate aneurism of the innominate artery.

But there are many *exceptions* to these general rules. Thus, the pulsating tumour of *aortic aneurism* may rise in the form of secondary

commencement of the carotid pressure-effects—varying in degree the most part, to surrounding general resemblance to those produced.

They are—dyspnœa, dysphagia, and right arm, with œdema and pain.

Dyspnœa arises from the mechanical pressure of the tumour, and in the case of innominate aneurism, or from pressure on the right bronchus. The first occasion of dyspnœa is accompanied by hæmoptoe, loss of voice, paroxysmal cough, &c.

Dysphagia may be more or less caused by enlargement of the external jugular vein, and by the pressure of those below the clavicle in front of the trachea. It supervenes in the right eyelids, face, and neck. The *pain* has the usual heavy exertion, and is increased by the tumour, and acute intermission of the cervical and brachial plexus of nerves. It is on the right side of the neck, head, and face, spreading upwards, and radiates down the arm to the fingers. The right arm commonly supervenes last.

The *diagnosis* from Tumours of the neck, must be guided by the difference in the connection with ANEURISM.

TREATMENT.—*Constitutional treatment* for Aneurism in general—is said to be the same in all instances. *Tracheotomy* may also be performed in some circumstances, and with the same precautions, as with regard to aortic aneurisms. A cannula might be entered, as Mr. Spence suggests, into the carotid, which should be drawn down

is impracticable in some cases; and has been *fatal* in its result with regard to all the cases in which it has hitherto been practised, except in one instance.

1. CAROTID ANEURISM ALONE, AT ROOT OF THE NECK.—*Distal* ligature of the artery.—Six cases are recorded by Norris, in four of which the result was *successful*. This proportion is sufficient to justify a repetition of the operation, under favourable circumstances.

2. SUBCLAVIAN ANEURISM ALONE, AT THE ROOT OF THE NECK—i.e. situated either internal to, or between, the *scaleni*.—*Distal* ligature of the artery, in the *third* part of its course.—This operation has been proposed, but I am not aware that it has ever been practised. The *axillary* artery below the clavicle, under the pectoral muscles, was ligatured by Dupuytren for subclavian aneurism; and this distal operation proved fatal, on the ninth day, from hemorrhage. In three other cases, by Pétrequin, Schuh, and Canton, the results were equally disastrous. *Amputation* at the shoulder-joint, *with*, therefore, *distal* ligature of the artery, was suggested by Sir William Fergusson; the presumed advantage being, that the tumour might then be much more under the control of pressure, as the supply of blood below would no longer be requisite. This operation has been tried by Mr. Spence, of Edinburgh, and by Mr. Holden; and in both cases with a temporarily favourable result.

CAROTID ARTERY.

Aneurism.—SYMPTOMS.—The usual symptoms of an aneurismal tumour are present, and well marked, owing to the situation of carotid aneurism. The *pressure-effects* are similar to those of carotid, subclavian, and innominate aneurisms, at the root of the neck, and those also of aneurisms of the aortic arch; so far as their anatomical relations are similar.

Aneurism of the *external* carotid arises higher up in the neck, behind the angle of the jaw; and as the sac enlarges, the *pressure-effects* of the tumour varying according to its anatomical relations, the phenomena may be so far differential.

The DIAGNOSIS of carotid aneurism must have regard to the various kinds of pulsating tumour which are liable to occur in connection with the carotid artery. 1. *Enlarged lymphatic glands*, and *tumours, cysts*, and *abscess*, situated on or communicating with the artery, may severally simulate aneurism. They are all pulsating swellings; but differing in the less expansive character of the pulsation, and the incompressibility, possibly, of the supposed aneurism. The history of the case will aid the diagnosis, as in that of abscess. The fluid, as well as the pulsating, character of any superimposed cyst or abscess, or when communicating with the artery, and virtually forming an aneurism, are the two conditions which require the utmost caution in diagnosis. 2. *Pulsating* tumours present even more perplexing difficulty. Pulsating enlargement of the *thyroid body* differs from a supposed aneurism, in its situation, and more particularly in the tumour moving up with the trachea in the act of deglutition. Any tumour, *not* communicating with the carotid artery, can be raised from the vessel, when the aneurismal symptoms will be found to cease; excepting the thrill of a pulsating tumour. *Aneurismal*

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TREATMENT.—1. *Digital comp*
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Recurrence of pulsation of the
common trunk—on the cardiac side
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INTERNAL

DIAGNOSIS.—Internal carotid aneurism may thus simulate abscess of the tonsil. The marked pulsation of the tumour in its pharyngeal aspect, which can be both seen and felt expanding with each beat into the mouth, will principally determine the diagnosis.

TREATMENT.—*Digital pressure* on the common carotid should be tried in the first instance. *Ligature* of that artery is the only available operative procedure, subsequently. Its results are uncertain.

Intra-cranial Aneurism.—Within the cranium, aneurismal dilatation of the internal carotid may occur in either of the three parts of its course: (1) in the carotid canal; (2) in the cavernous sinus; (3) in relation to the brain. Aneurisms of the other cerebral arteries are conveniently associated with that of the carotid in the latter situation.

(2.) In the CAVERNOUS SINUS the *symptoms* are mainly those of aneurism, of pressure on the orbital nerves, and of disturbance of the cerebral circulation. Thus, arising, probably, from a blow or other injury, the person who is the subject of cavernous carotid aneurism, hears a sharp crack, followed by a sawing or rasping noise, which may also be heard by the stethoscope applied to the head or neck; but this sound ceases when pressure is made on the common carotid of the side affected. No tumour can be discovered externally. Pressure on the orbital nerves is announced, either by internal strabismus from paralysis of the sixth nerve, or by association with external strabismus and dilated pupil from pressure on the third nerve, or by loss of sensation in the parts supplied by the supra-orbital nerve. The sense of vision usually remains unimpaired, or there may be double vision or other defect of sight. These affections of the orbital nerves exist singly or in combination. Cerebral disturbance is evinced by giddiness, headache, a sensation of fulness on stooping, and sleeplessness or disturbed sleep.

Diagnosis.—Similar symptoms may arise from any occasion of pressure on the artery in the sinus; as by coagula formed in the ophthalmic vein, or in the cavernous, circular, transverse, and superior petrosal sinuses. Otherwise the diagnosis of cavernous carotid aneurism can be made with tolerable certainty.

INTRA-ORBITAL aneurism is associated in point of situation and origin; the aneurism springing from the carotid artery, or, in some cases, from the ophthalmic branch. Aneurismal *varix* has sometimes been found after death; the internal carotid communicating with the cavernous sinus. In addition to the *symptoms* of intra-cranial aneurism, some protrusion of the eyeball will be noticed, with pulsation of a throbbing character in the orbit; the conjunctiva becomes congested, and the eyelids are swollen. Vision is impaired or lost.

ANASTOMOTIC ANEURISM, or erectile tumour within the orbit, is an independent formation, and occurs more rarely.

Diagnosis.—The following general distinctions are worthy of notice: 1) Aneurism by anastomosis comes on gradually, mostly in early life, as the result of the growth of a congenital naevus; aneurism of the orbit very suddenly, often as the result of a blow, and almost always in advanced life; (2) aneurism by anastomosis occurs in the subcutaneous tissues; aneurism of the orbit generally in the deepest part of the cavity; (3) aneurism by anastomosis involves all the neighbouring vessels, arteries, and veins, in active disease; aneurism of the orbit is generally limited to

a single part, or if the neighbouring vessels are dilated, they seem enlarged from obstruction; (4) ligature of the trunk of a vessel led to an undoubted aneurism by anastomosis is an extremely unsuccessful operation, in aneurism of the orbit a very successful one; (5) lastly cases dissected have turned out to be common aneurism. The diagnosis of *anastomotic* aneurism may perhaps be determined by the presence of soft, compressible, thrilling tumours in various parts of the eye collections of veins apparently, transmitting pulsation from the subclavian aneurism.

(3.) AT THE BASE, OR IN THE SUBSTANCE OF THE BRAIN, aneurism of cerebral branches of the internal carotid, or of the cerebellar arteries, is liable to occur. The *symptoms*, if any, are very equivocal; pressure arising possibly from other causes than cerebral aneurism, and the diagnosis, therefore, is equally obscure. The sensation of a sawing or rasping noise in the head, varying with the circulation, and which probably has supervened shortly after some injury, may be suggestive of aneurism; a suspicion corroborated, perhaps, by careful auscultation of the head, leading to the detection of a bruit.

The *middle meningeal artery*—a branch of the internal maxillary from the external carotid—is occasionally the seat of intra-cranial aneurism, giving rise to similar symptoms. But absorption of the cranial matter having occurred from continued pressure, a small pulsating tumour may be presented, somewhere in the course of the vessel. The resemblance to a cyst in the scalp will thus be distinguished.

Diagnosis.—Symptoms referable to pressure may arise from any intra-cranial tumour; and similar symptoms ensue from softening of the brain. Hemiparesis or partial paralysis, blindness, deafness, or other affections of the special senses, are symptoms of an equivocal character.

TERMINATIONS.—The pressure of an intra-cranial aneurism is followed by softening of the portion of brain, or cranial nerve, in contact; possibly, absorption of any opposing portion of bone. Symptomatic paralysis supervenes. *Death* ensues by hemiplegia, or from apoplexy after rupture of the aneurismal sac; the latter mode of death occurring frequently in earlier life.

TREATMENT.—*Digital pressure* on the common carotid artery may be sufficient to overcome the symptoms wherever intra-cranial aneurism is situated, and it has also proved successful in intra-orbital aneurism.

When this method of treatment has failed, *ligature* of the common carotid is the only known resource. Great success has attended operation in intra-orbital aneurism. Aneurismal *varix* in the orbit has thus also been cured, in a case related by Mr. Hart. Digital pressure would seem to be at least advantageous in any case, as preparatory to operation; dilatation of the collateral arteries preventing the otherwise rapid development of symptoms which are apt to follow the latter procedure.

SUBCLAVIAN ARTERY.

Aneurism.—*SYMPTOMS.*—Aneurism of the subclavian artery presents a pulsating tumour situated immediately above the clavicle, and commencing external to the margin of the sterno-mastoid muscle, the third part of the subclavian usually being affected. Its apparent size varies with the

tion of the shoulder, for the tumour disappears partly below the clavicle when the shoulder is raised. Pressure on the brachial plexus is accompanied with pain, and numbness down the arm even to the fingers; and the phrenic nerve also sometimes becoming disturbed, there may be spasmodic action of the diaphragm—hiccup—as an occasional symptom. The external jugular and subclavian veins suffering compression, œdema, particularly of the hand and arm, will be conspicuous in most cases.

DIAGNOSIS.—Other tumours may occasion similar symptoms; their differential characters, compared with those of aneurism, should therefore be remembered in considering the diagnosis. (See TUMOURS IN THE NECK.)

TREATMENT.—*Ligature of the subclavian*, on the cardiac side, in the first part of its course.—This operation has been practised for the cure of subclavian aneurism—in the third part of the vessel—i.e. beyond the scaleni, and when situated between these muscles—the second part. In fourteen cases, all were fatal, in periods varying from the fourth to the thirteenth, twenty-second, and thirty-sixth day; and uniformly from hæmorrhage, excepting in one case, where death occurred from pericarditis and pleurisy, and in another, from pyæmic infection.

On the left side, the subclavian has been tied in the first cervical part, by Dr. Rodgers, of New York; but Sir A. Cooper failed to secure the vessel, and the operation has not been resorted to by other Surgeons.

Ligature of the innominate artery has also been fatal, almost beyond hope.

Direct pressure on the sac has proved successful in three cases; a small but most acceptable contribution in favour of this method of compression, seeing that pressure on the cardiac side is scarcely ever practicable, and that the results of ligature have been disastrous.

Aneurism of the subclavian, in the first part of the artery—internal to the scaleni—might admit of compression, or of ligature, on the distal side of the tumour; but with what success remains to be shown.

AXILLARY ARTERY.

Aneurism.—**SYMPTOMS.**—The situation of the pulsating tumour of Axillary Aneurism is characteristic. It rises immediately below the clavicle, under the great pectoral muscle, or under the anterior fold of the axilla, if the second, or third, portion of the artery be the seat of aneurism. Pressure on the brachial plexus occasions pain and numbness, extending down the arm and hand; œdema of the upper extremity also occurs from pressure on the axillary vein. But the situation of the tumour distinguishes it from subclavian aneurism, a very important distinction as to the portion of artery eligible for ligature.

DIAGNOSIS.—Other tumours may be recognized by their differential characters. An abscess pulsating over the subjacent artery resembles aneurism in situation, but differs in the antecedent symptoms of inflammation. Pulsating tumour of the head of the humerus resembles aneurism in symptoms varying only in degree, but differs in situation, for it presents on the front of the shoulder.

CAUSES.—A blow or fall on the shoulder, violent movement, or other injury to the joint, is the mode of origin traceable in most cases. Forcible

Ligature of the subclavian operation is the only resource, but the deaths being above 40 per cent, also from suppuration of the

The *catgut* ligature has been used in part—for the cure of axillary aneurism—than silk ligature.

ABDOMINAL AORTA; ANEURISM OF THE INTERNAL,

Aneurism.—**SYMPTOMS.**—The symptoms of aneurism are similar to those of an aneurism of the aorta, the pulsations of which can be felt, and are compressible, and subsiding if pressed above. The *pressure-effects* are the pressure of the tumour to adjacent viscera; the pressure on the nerves and venous trunks suffer compression. The lumbar plexus, pain is experienced in the thigh and leg, if the anterior crural artery is compressed, while œdema of the limb is occasional in the common or external iliac vein.

DIAGNOSIS.—Other tumours may be mistaken for aneurism exclusive of aneurism affecting various parts. Thus the superior mesenteric, the inferior mesenteric, and the renal arteries, may severally give rise to aneurism; and probably in the other cases such cases are very rare.

Internal *abscess*, pulsating perhaps, must be remembered as a source of error in diagnosis. Various *solid* tumours, such as aortic pulsation,—although less likely to be mistaken for aneurism, cancer, enlarged lumbar vertebrae, may have to be distinguished from aneurism.

ruit is less marked or absent; (2) the pulsation is more sudden, strong and expansive, and equally forcible whether the tumour be small; while in aneurism, the force of pulsation is proportionate to the size of the tumour; (3) the bone connected with a pulsating aneurism is expanded, thus presenting a considerable osseous enlargement at the seat of disease—e.g. the ilium on either side of a tumour situated in it; an aneurism simply eating an aperture, the margin of which may be felt if the tumour can be made to collapse. (4) Pulsating aneurism of bone is very commonly cancerous, and accompanied, therefore, by the evidence of this disease.

Treatment of abdominal or pelvic aneurism—i.e. the particular artery involved will obviously be an important consideration in relation to treatment, any operative proceeding.

Internal treatment.—Internal treatment is specially efficacious for the cure of abdominal aneurism. This failing, no time should be lost in having recourse to other measures.

Compression of the artery above the aneurism is practicable only in certain persons, and those who can bear prolonged compression of the artery against the vertebral column. But, under the influence of this method of treatment has yielded successful results in a large number of six cases. On the *distal* side, pressure was abortive or fatal in most cases. It can be effected, instrumentally, by means of a pad, or by digital pressure. This procedure must be conducted with great precautions. The bowels having been freely evacuated by purgatives, as castor oil, and an enema, the compressor is carefully applied to the aorta, just above the aneurism, and with only sufficient force to stop pulsation in the femorals. To prevent the tendency to ischæmia and œdema of the lower extremities, they should be encased in flannel and bandaged. In the event of syncope, the pressure should be relaxed, and troublesome vomiting, which often occurs, may be relieved, when not due to the anæsthetic. In the course of three or four days, or perhaps not exceeding twenty-four, the aneurism may become consolidated; or it may be deemed advisable to repeat the operation on two or three occasions, each of shorter duration.

In the cure of *Iliac aneurisms*, compression has been applied with success in several cases.

Ligature of the Abdominal Aorta.—This desperate operation has been performed in eight cases or more.

Ligature of the Common Iliac.—This operation has not been uniformly successful in its results.

In a total number of cases of ligature of the common iliac, 39, 29 were recovered; in 9 the peritoneum was wounded, and 10 were fatal.

COMMON FEMORAL ARTERY.

Aneurism.—**SYMPTOMS**.—The pulsating *tumour* of aneurism of the femoral trunk arises in the groin, but it may pass partly upwards towards the abdomen. Situated, otherwise, external to the pelvis, the signs of aneurism are more readily perceptible than when the tumour is internal. Its *pressure-effects* are evinced by pain in the groin and

er's canal—is not only more deeply placed, but is supported by the tensor muscles, and resisted by the aponeurotic covering of the canal, the superimposed sartorius muscle; as well as by the fascia lata, fascial fascia, and integument. The pulsating tumour, therefore, has characters less distinctly aneurismal.

THE PRESSURE-EFFECTS of Femoral aneurism—whichever portion of the artery is affected—will consist in the pain and œdema produced by compression of branches of the anterior crural nerve, and of the femoral and its branches. In Hunter's canal, the internal saphenous nerve—a branch of the anterior crural—and the femoral vein, are here peculiarly subject to pressure.

TREATMENT.—*Compression of the Common Femoral*, in the groin, should always be tried in the first instance. It has been known to succeed, even when the aneurism has burst and become diffused. If the aneurism continues to increase, the establishment of a tolerably free collateral circulation will prepare the way for the next resource. Under the use of chloroform, *rapid* compression has proved successful in some cases of ilio-femoral aneurism—pressure being made on the external iliac, and the common iliac.

Ligature of the Common Femoral, in the groin.—The results of this operation are decidedly unfavourable. Secondary hæmorrhage is apt to follow, owing apparently to the contiguity of arterial branches—the external iliac above and the deep femoral below the ligature; the free communication of which vessels is, however, requisite for the collateral circulation. Gangrene, on the other hand, is apt to ensue, in the event of the arterial trunk becoming occluded below the ligature, thus shutting off the supply of blood through the deep femoral, as well as through the superficial femoral leading to the aneurism.

Ligature of the Superficial Femoral will be practicable only in cases where the portion of this artery, between the sac below and origin of the deep femoral above, is of sufficient length for the application of a ligature.

the beat of the vessel also, in its course separate.

The PRESSURE-EFFECTS of popliteal aneurisms, pain and œdema, preceded by some semi-flexed position of the limb. Lame the earliest symptoms of the disease.

The DIAGNOSIS is usually unequivocal, use the joint may be mistaken for *rheumatism*, connection with the popliteal artery have to them—*e.g. chronic abscess, a cyst, or a tumor*. The pulsation, however, is less extensible, and it does not subside on pressure; differences disappear in the event of aneurism; thus so far resembling a solid tumor can, perhaps, be lifted off, and isolated pulsating and apparently aneurismal character the case will aid in determining the diagnosis regard to chronic abscess.

CAUSES.—Some *strain* in flexion or extension the usual mode of origin. Hence, popliteal aneurism frequently in persons accustomed to the act of jumping, or who ride hard on horseback. More liable than females. Of 155 cases in 120 females. The *period of life* most liable is middle age, compared with other aneurisms, popliteal aneurism associated with a diseased state of the artery; consequently, in other parts of the body affected with equal frequency, and occasionally the other hand, compared with other arterial aneurism.

TREATMENT.—*Genuflexion* should be continued, bending the knee back on the thigh stops the progress of this treatment may be continued. The limb should be kept nearly to the knee, the roller should be applied, the leg being flexed.

anism, or cause fatal syncope. To prevent any such risk, Mr. Gould recommends that an excess of blood should be retained in the other limb, by the exclusive enclosure of a Junod's boot, and so relieve the heart and arterial circulation.

Compression of the Femoral Artery.—Instrumental or digital compression may be readily effected; care being taken that the pressure be directed rather outwards against the femur, as the vessel winds to the inner side of the bone in its course down the thigh to become popliteal. But this mode of treatment may be unbearable. Or, the tumour still enlarging, compression will no longer prove sufficient to induce consolidation of the aneurism, and still less so, if the sac has burst, and diffused aneurism is established, gangrene is imminent.

Ligature of the Superficial Femoral.—This operative proceeding becomes necessary under the circumstances adverse to compression, or its continuance. Surgical experience differs as to the advantage or disadvantage of compression before the application of a ligature. But, if pressure is continued only for a short period—sufficient to establish a collateral circulation—we not only thus give the patient the benefit of curative treatment unattended with any danger, but ligature may be resorted to under more favourable circumstances than by a sudden arrest of the circulation in the limb. Ligature of the superficial femoral has been attended with more *successful results* than that of any other main artery. The vessel is usually secured at the apex of Scarpa's triangle, just as it is under the sartorius muscle.

Gangrene would seem to be the chief cause of death after ligature of the femoral for all purposes, including popliteal aneurism.

Return of pulsation in the sac sometimes occurs, but it rarely is of any consequence. Compression of the artery above will, mostly, control such unfavourable tendency.

Secondary hæmorrhage should be met by ligature of the artery above the common femoral, or the external iliac; pressure with a graduated

cellular character, and the pulsation of the enclosed vessel, immediately beneath the finger—that structure should be slightly raised with the forceps, into a small cone off the artery, and the knife being laid flat under the pinch of the forceps, a small aperture is cut in this portion of the sheath. The artery thus exposed through the aperture will be recognized by its whitish-yellow or fawn colour. Enclosed within the sheath, by the side of the artery, lies the companion vein, or two such veins, *venæ comitantes*, one on either side, in relation to a second-sized artery. It, or they, have a dark-blue colour, contrasting with the colour of the artery; but an enclosed vein may be only partially visible through the small aperture in the sheath. A nerve also is sometimes enclosed, as the pneumogastric within the sheath of the carotid, but it has less immediate relation to the artery; while external to the sheath, the collateral nerve or nerves already referred to will be seen, in immediate relation to the artery.

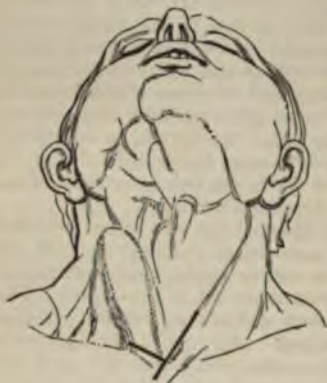
An *aneurism-needle*, armed with a waxed silk ligature, or carbolized catgut, is introduced through the aperture in the sheath, *between* the vein and artery, and turned round the latter; their cellular connection having, previously, been gently separated, if necessary, by scratching with the point of the needle. The *ligature* is drawn out from the eye of the needle, and the needle itself withdrawn; leaving one end of the thread on the other side of the artery. Special care should be observed *not* to *slide* the ligature up and down the artery, nor to *lift up* the vessel much from its bed; whereby, in either way, the nutrient *vasa vasorum* would be cut or torn off, endangering sloughing of the vessel and secondary hæmorrhage. The ligature should be tied *transversely* round the artery, as an oblique direction of the noose would be liable to loosen; the ends of the thread must be drawn moderately tight, so as to divide the two inner coats of the vessel, and then the thread tied again, forming a reef-knot.

It must be observed in these proceedings, that the *vein* be not wounded or transfixed, nor any adjacent *nerve* included in the ligature *with* the artery. But care should also be taken not to ligature any extraneous structure *instead* of the vessel; as a nerve, or portion of the sheath. The finger placed on the *distal* side of the artery will at once discover whether pulsation is stopped, and the vessel secured. One end of the ligature is then to be snipped off close to the knot on the vessel, and the other end left hanging out of the wound, guarded by a small strip of adhesive plaster, or *both ends* of a catgut ligature are cut off short, close to the artery; and, lastly, the incision closed by a few points of suture.

Ligature of an Artery at the seat of a Wound, involving the Vessel.—The wound is here used as the incision, leading down to the artery. It may require to be enlarged, as in the case of a punctured or other narrow wound; and much difficulty may be experienced in finding the vessel, owing to the infiltration of surrounding textures with blood. The artery may be found *punctured*, or completely *divided*. In either case, the rule of treatment for securing it and arresting hæmorrhage is the same. A ligature must be applied on either side of the aperture, or to either cut extremity; this *double ligature* being necessary to stop the hæmorrhage from the distal, as well as the cardiac, end of the artery—which would otherwise continue to bleed by the anastomotic supply of blood from above the upper ligature. In this procedure, a tourniquet is placed on the limb above, to control the main trunk. The *intervening*

Ligature of the Innominate or
OPERATION.—The innominate may be reached by the following method. The patient being placed in the recumbent position, the head being well back, exposing the root of the neck, a vertical incision is made at the episternal notch near the right sterno-clavicular articulation.

FIG. 1.



down to the innominate. A round curved needle is then passed under the vessel, and a ligature, is then passed around the vessel, all the skill the Surgeon can command. A small portion of the vessel can be detached, when felt under the vessel, and the vessel is the critical part of the operation.

The innominate has been reached *ante* the sternum and sternal end of the clavicle by Dr. J. P. Kennedy of San Francisco, in a case where the upper part of the vessel was diseased.

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ligature of the Common Carotid.—OPERATION.—The patient is placed in a recumbent position, with the head thrown back and the face turned a little from the side of the operation; exposing the side of the neck. The *apex* of the carotid triangle, the *omo-hyoid* muscle crosses the artery, is selected, if possible, as the seat of ligature; the *inner margin* of the *sterno-mastoid* muscle is the guide to the artery. An

incision, from two to three inches long, is made along the inner edge of this muscle, so placed that the centre corresponds to the lower border of the thyroid cartilage (Fig. 2). The superficial fascia, and platysma muscle, are divided. Turning the head so as to relax the *sterno-mastoid*, the *deep fascia* must be carefully divided, and the sheath of the exposed, with the *omo-hyoid* muscle, is divided. The *thyroid* veins, turgid with blood, passing across the sheath of the artery, and the *descendens noni* (vagus) are drawn to the side of the wound with a retractor by an assistant. The operator, introducing his finger into the wound,

FIG. 2.



feels the artery beating between the trachea and *sterno-mastoid* muscle.

The sheath is now opened in the usual way, by a pinch up with the thumb and lateral application of the knife; the aneurism-needle should be insinuated on the *outer* side of the artery, between it and the sheath, taking care not to include the *pneumogastric* nerve in dipping the needle under the vessel: the ligature is then drawn through and secured, without disturbing the vessel.

If the operation lower down in the neck necessitates the division of the lower portion of the *sterno-mastoid* muscle. The *sterno-hyoid* and *sterno-thyroid* muscles may be drawn to the outer side. Any *thyroid* veins crossing the internal jugular, which, on the *left* side, inclines to the front of the artery, will also be thus avoided; and the ligature is then passed.

LATERAL CIRCULATION.—After ligature of the common carotid artery, the supply of blood to the head—within the cranium, is carried on by the *vertebral* artery, from the subclavian, on either side, forming the *basilar*, and the *internal carotid*, from the *opposite* side,—both of these arteries issue in the anastomotic circle of Willis. Thence they are conveyed to the cerebral and ophthalmic branches of the internal carotid on the side of the ligature. From the *thyroid axis* also of the trunk, and from the *superior intercostal*, blood is conveyed, through the branches of the external carotid,—to the neck, and head externally. The inferior thyroid from the axis, communicates with the superior thyroid from the external carotid; and the ascending deep cervical branch of the superior intercostal, anastomoses with the occipital branch of the external carotid. From the *opposite* side, the branches of the

angle of the incision, identify this artery, the sheath of the vessel to be ligatured, betwixt it and the vein; as in the operation.

Ligature of the Lingual Artery.—The artery can be more readily reached, if need be, by following its course; and the *upper border* of the hyoid bone will guide to the artery in an access to the head so as to expose the digastric triangle. The incision should be made from below the *cornu* of the hyoid bone, to the border of the digastric muscle. (Fig. 2.) Dividing the skin, platysma, and digastric muscle, the artery may be drawn forth, *above* the *cornu* and *below* the hyoid bone. It must be taken not to penetrate the *pharynx*—where the vessel here rests; and such caution in the operation of the pharyngeal bag arises and subsides upon the completion of the ligature presents no special difficulty.

Ligature of the Superior Thyroid Artery, Internal Maxillary, and Occipital Artery.—The External Carotid may have to be ligatured in the case of Wounds or Traumatic Aneurism. The vessel is then guide to either of these vessels, which are superficial, and easily reached. But in the event of an aneurism having formed, the clots must be turned out, and morrhage. Double ligature must be applied to the vessel, either to a punctured wound, or to either end of a divided vessel.

Ligature of the Subclavian.—OPERATION.—A *transverse* incision over the *clavicle* and *mastoid* leads down to the vessel in this part. But a *vertical* incision also along the *inner border* of the *trapezoid* is added, if necessary, for space; and the vessel is raised, with the platysma and fascia. The clavicle and the sterno-hyoid and sterno-thyroid muscles are divided transversely.

over the *clavicular origin* of the *sterno-mastoid*, from two to three inches in length, is met by a *vertical* incision about two inches higher external to the *outer border* of the *sterno-mastoid*; and the skin, *platysma*, and *fascia* is raised upwards and inwards. The *jugular vein* may be conveniently drawn outwards. The upper portion of the *sterno-mastoid* must then be divided inwards, and may be necessary to expose the *anterior scalenus* clearly. The *nerve* lying on that muscle, and the *internal jugular vein* along its border, are to be drawn inwards, and guarded with a retractor. Carefully dividing the muscle with caution, from without inwards, the artery comes into view. The aneurism-needle should be passed from outwards.

and the *scalenus*.—The shoulder being depressed as low as possible the skin of the neck drawn down over the clavicle, a *transverse* incision is made along the *clavicle*, extending from the border of the *sterno-mastoid* outwards to the *trapezius muscle*, and in depth down to the skin. (See Fig. 2.) The skin, *platysma*, and *fascia* are thus separated.

On allowing the integuments to resume their place, the incision is to be just above and parallel to the clavicle. If there be reason, as explained, to suppose that the artery lies deeply, a *vertical* incision is added, as in figure, along the *outer border* of the *sterno-mastoid*, and meeting the *transverse* one below at a right angle. The *sterno-mastoid* or *trapezius* approaching each other along the clavicle in some cases, either or both these muscles may be here divided sufficiently to reach the artery on the first rib. The *external jugular vein* is drawn inwards, and the *deep cervical fascia* cautiously divided to expose the artery. The *supra-scapular artery* running outwards nearly parallel to the clavicle, must be drawn down, and the *omo-hyoid muscle* drawn outwards, thus also guarding the *transverse cervical artery* from the junction of the *omo-hyoid* and *sterno-mastoid* muscles—the *axillary angle* of the triangular space in which the subclavian lies. The *axillary artery*, now fairly seen; with the three cords of the *brachial plexus* above, and the large, turgid, blue *vein* below. On passing the finger down the *anterior scalenus* muscle on the upper surface of the rib can be felt, and thus the position of the artery ascertained; lying, as it does, on the *outer side* of the rib. Avoiding the *subclavian vein*, the aneurism-needle should be introduced between it and the artery, but care must also be taken not to divide the lowest of the three nervous cords, as the point of the needle emerges on the opposite side. The depth and narrowness of the artery in some cases, may render this proceeding perplexing, and considerable difficulty may be experienced in fixing the ligature, it being impossible to reach the vessel with both forefingers. As a substitute is recommended a *serre nœud* to be used—a strong wire, straight or notched at one end. One only, or two, may be employed, according to the judgment of the Surgeon. Of course, the point on the pulsation below should be ascertained before tightening the wire. Sutures having been inserted to bring the edges of the wound together, the limb must be elevated and wrapped in cotton wool to maintain the circulation, as after the ligature of any other main artery.

ARTERIAL CIRCULATION.—(1.) In the normal arrangement of branches,

costal arteries with the thoracic branches
ligature of the subclavian, *internal* to the
the distal side of the trunk, mainly by the
inferior thyroid of the thyroid axis;
superior intercostal arteries; and the
through its *thoracic branches*.

Ligature of the Vertebral Artery
has been ligatured in a few cases; either
or in aid of the cure of Subclavian An
the subclavian and common carotid, the v
Smyth, of New Orleans, to control regu
and with a successful result. In another
clavian and carotid arteries, Dr. W. Park
former Surgeon thus describes his operatio
being thrown back, and slightly turned to
along the *posterior border* of the *sterno-*
two inches, commencing at the point wh
crosses this muscle, and terminating a litt
of the muscle being exposed and drawn in
tubercle of the transverse process of the s
guide to the artery in front. Dividing a
cervical artery, with lymphatics, were d
separating the scalenus anticus and longu
its vein were exposed, and the latter vess
needle was passed from without inwards, a

Ligature of the Internal Mammary
this operation was first performed, give
reaching the internal mammary artery:—
length, is to be made near the *edge* of the
downward and from without inward, form
an angle of forty-five degrees. The midd
be three or four lines distant from the n
the centre of the sternal end of the int
Dividing successively the

the edge of the sternum, which separates these fibres from the Then, nothing is easier than to isolate the artery and to slide the curved end of an aneurism-needle, for passing the thread."

In regard to this procedure, it should be observed that, simple as it is on the dead subject and when the artery is injected, the circumstances under which the operation may be requisite, or deemed advisable, are one of the most difficult in the practice of Surgery. Thus, in the wound of the sternum, attended with profuse hæmorrhage, or from the internal mammary artery, forming a large bloody clot with an accumulation of clots in the mediastinum,—then, indeed, the relations of the vessel are altogether changed, although the life may justify immediate interference. But hæmorrhage from the internal mammary artery may be more readily controlled by compression in the case of an intercostal artery; a small bag being introduced into the wound, and then stuffed with lint, the bag is withdrawn and effectually compress the vessel against the posterior aspect of the

Ligature of the Axillary Artery.—**OPERATION.**—Above the small pectoral muscle. An incision is

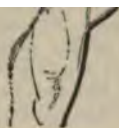
made under the clavicle, extending from near its sternal end to the interval between the pectoralis major and pectoralis minor muscles, on the side of the acromion (Fig. 3). The pectoralis minor muscle is next divided to this extent, and the axillary sheath cautiously opened. Then the cephalic vein is drawn down to the outer side, protecting the cords of the brachial plexus more deeply. The axillary vein is drawn down to the chest, and the aneurism-needle passed under the vein within outwards. If the axilla of the acromial thoracic is wounded, it will bleed profusely as an aperture into the axillary trunk; and the inclusion of either anterior thoracic nerve should be avoided in passing the ligature.

With the small pectoral muscle, the artery should not be selected for dissection, owing to its greater depth in that part of its course, and its intimate relation to the cords of the brachial plexus. But the line of incision is indicated in the figure.

Below the small pectoral, the artery is most superficial and accessible, only beyond the great pectoral muscle. Abducting the arm and flexing the forearm will bring the vessel even more to the surface, and free it from the nervous cords, surrounding it. An incision about three inches long may be made from the lower border of the great pectoral muscle downwards over the course of the artery, along the border of the latissimus muscle, dividing the skin and fascia (Fig. 4). The

FIG. 3.





funda artery; and by the inosculatio of the axillary and brachial arteries triceps muscles.

Ligature of the Brachial A artery may be ligatured in either part.

In the *first* portion, or that which muscle, the artery is reached as in the the brachial being less encompassed. An incision along the border of the the skin and fascia, leads down to the fascia is then divided, and on drawing the artery, with its *venæ comites*, is a *nerve* to the inner side or in front of the aneurism-needle may be passed most convenient to the operator, and But I have frequently included one second-sized artery, and without any

The *second* portion of the brachial is ligatured in a similar manner. A long, is made on the inner border of the *basilic vein*; having reached the obliquely or at the inner side, may be The artery, with its *venæ comites*, will readily passed.

The *third* portion of the brachial requires ligature only for wound of external wound will guide to the aperture itself lying on the inner side of the

TERAL CIRCULATION.—In the normal arrangement of branches, one of the brachial artery, the collateral circulation will depend on to which the ligature is applied. (1.) When applied to the artery at part of its course, the supply of blood is carried on through the *circumflex* and *subscapular* branches of the axillary artery, which unite with the ascending (muscular) branches of the *superior profunda* of the brachial. (2.) After ligature of the *second*, or the *third* part of the artery, the circulation is restored by the *superior* and the *inferior* branches, with the *anastomotic* branch, communicating with the branches of the radial, ulnar, and posterior interosseous arteries, forming a free anastomosis around the elbow-joint. Thus, the superior inosculates with the radial recurrent, beneath the supinator muscle, in front of the joint, and also meets the recurrent branch of the anterior interosseous, coming forward from behind; the inferior inosculates with the posterior ulnar recurrent, between the inner condyle and the olecranon, at the back of the joint; while the anastomotic branch joins also the anterior ulnar recurrent, beneath the pronator radii teres muscle, in front.

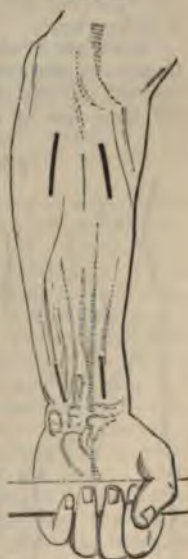
Ligature of the Radial Artery.—**OPERATION.**—In the *upper* or *middle* part—an incision along the *inner* or *ulnar* border of the *supinator longus* (Fig. 5), and through the *fascia*, will lead down to the artery, which is not overlaid by that muscle; its fibres being directed by their vertical direction from those of the pronator teres, obliquely crossing the line of the artery. Drawing the supinator, and with it the *flexor carpi ulnaris*, outwards, the artery is seen with its *branches*, one of which commonly lies in front. At the *site*, the needle, it is unimportant whether it is *passed* and ligatured.

It is *passed* down and superficial towards the wrist, and on the *outer* or radial side of the *flexor carpi ulnaris* tendon (see Fig. 5) leads to the vessel, *deep* fascia; lying about midway between the *line* of the pronator and that of the supinator longus. The *artery* is here quite out of the way, and the *sites* are unimportant.

At the *back* of the *wrist*, and in the *palm*, the artery is tied only for *Wound*, and at the wounded *site* in the former situation, as the artery passes between the end of the radius to the apex of the first *metacarpal* space, it is *crossed* by the tendons of the *extensors* of the thumb, successively; the *extensor* of the *metacarpi pollicis*, and the *extensors* of the *secundi internodii pollicis*. Either of these may guide to the wounded artery.

Ligature of the Ulnar Artery.—**OPERATION.**—In the *upper* or *middle* part, an incision along the *outer* border of the *flexor carpi ulnaris* down to the vessel as it lies between this muscle and the *flexor carpi sublimis* (see Fig. 5); the fibres of the former muscle being directed by their more vertical direction from those of the *sublimis*,

FIG. 5.



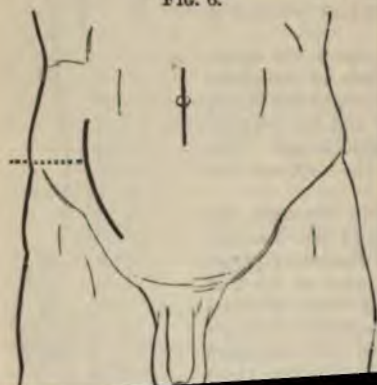
is performed only for Wound, and at

COLLATERAL CIRCULATION.—After ulnar arteries, the collateral supply of of *recurrent branches* around the elbow *branches* from these arteries below. T in the palm of the hand, also complet

The *anterior interosseous* artery, of the same arteries, may supply blood for wound of the palmar arch. Some accompanying the median nerve, may of hæmorrhage.

Ligature of the Abdominal Aorta.
Common, External, and Internal.
external, internal, and common, and e the same line of incision; commenci

FIG. 6.



the artery is crossed obliquely inwards by the *spermatic vessels*, *lateral branch* of the genito-crural nerve. *Between* these two points, a *triangular* needle can be passed most readily, with the usual precaution *placing* it *between* the artery and vein, here *below*.

LATERAL CIRCULATION.—After ligature of the external iliac artery, *each* limb is supplied with blood through the *deep epigastric*, which *freely* anastomoses with the *internal mammary* artery, and with the *intercostal* and *lumbar* arteries; the *deep circumflex* iliac, also *cooperating* with the *lumbar* and *ilio-lumbar* arteries, is an additional *source* of supply; while blood is conveyed by the internal iliac artery *from* the femoral trunk, through the *deep femoral*, its branches anastomosing *freely* with those of the internal iliac—both *circumflex* arteries, *external* and *internal*, communicating with the *gluteal*, the *internal* *perforating* with the obturator (at thyroid foramen), and with the *sciatic* and the *perforating* arteries inosculating with the *sciatic*.

The INTERNAL ILIAC is reached by the same incision, carried a *little* upwards and inwards, above the dotted line. (See Fig. 1.) The *artery* also is crossed by the *ureter*, which may be raised with the *finger*; the companion *vein* is somewhat *posterior*, and the *external* *is* *outside*, at the commencement of the vessel.

The COMMON ILIAC can be reached by prolonging the incision *upwards*, and curving it inwards, to the extent of six inches (see Fig. 2.) There is always an advantage in having the incision below the *middle* of Poupart's ligament—the loose connection of the *external* *oblique* fascia with the peritoneum, in that situation, facilitating the *retraction* of the latter membrane and raising it from the artery, *is* the most critical part of the operation. The common iliac *can* be found by tracing up the external iliac along the border of the *external oblique* muscle. But *higher* up the trunk ceases to have this *anatomical* relation to the muscle, and is most intimately related to the *trunk*; on the *right side*, the common iliac vein lying externally, *and* the *left common vein* passing behind the artery; while

circumflex iliac branch of the external also receives a large supply of blood, communicating freely with the *internal* of the rectus muscle.

The *internal iliac* is supplied through the *lumbar* branch with the *lumbar* artery; with the *middle sacral* artery; the *pubic* branch, communicates with the *external* and the *hemorrhoidal* (visceral) branch with corresponding branches, on the opposite side.

(4.) The ABDOMINAL AORTA may be exposed by the operation devised and performed with the following precaution of having the bowels well

FIG. 7.



through the *lumbar* artery; with the *middle sacral* artery; the *pubic* branch, communicates with the *external* and the *hemorrhoidal* (visceral) branch with corresponding branches, on the opposite side. The *peritoneum* the finger-nail under the aorta, and is viewed round it.

Ligature

Common an (1.) The Com tured, by an i the inferior m the origin of two inches be of this operati owing to the situation, and

passing over the sartorius, leads to the artery in some part of the thigh where that muscle crosses the artery. If the outline of the artery is perceptible, as in a thin person, the inner border of the sartorius will be the best guide; along which the incision may be made.

7.) Dividing the skin and superficial fascia, and avoiding any branch of the *saphena vein*, the thin bluish-white *fascia lata* should be cautiously divided or slit up on a director to the same extent. The *internal cutaneous nerve* may now be seen, and avoided, the sheath of the vessels. The artery, with the *vein* inclining to its inner side behind it—to gain the outer side—are to be gently exposed; and the needle introduced *between* them. Proper care must be taken to avoid wounding the vein or including it in the ligature; and the precaution observed of testing the aneurismal pulsation, by pressing with the finger on the presumed artery, before tightening the ligature.

Hunter's canal, the superficial femoral was originally ligatured by Hunter for popliteal aneurism, in the operation which he described (see Fig. 7); but it is not practised nowadays, on account of the difficulty of reaching the artery in this the deep part of its course, and with the facility of applying a ligature in Scarpa's triangle.

ARTERIAL CIRCULATION.—After ligature of the *common femoral* artery the supply of blood is carried on by the branches of the *internal femoral*—gluteal, sciatic, and obturator, which communicate with the branches of the *deep femoral*—as already noticed in connection with the *external iliac*. The *internal pudic* also anastomoses with the pudic branches of the *femoral*; and the *superficial circumflex iliac* anastomoses with the *external circumflex* of the *profunda*.

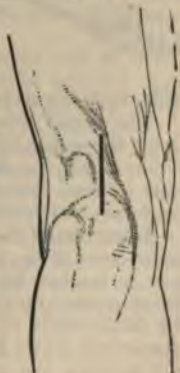
When the *superficial femoral* is ligatured, the supply of blood from the *profunda perforating* branches, and the descending

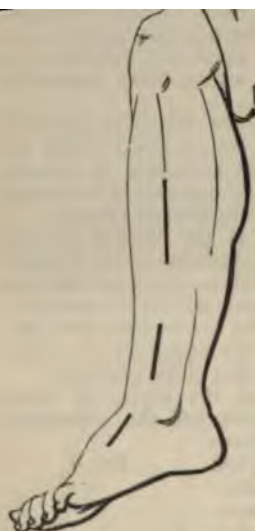
branches of the *external circumflex* artery, anastomose with the articular branches of the *popliteal*, and the *anterior branch* of the *anterior tibial* arteries—back and front of the knee-joint. This anastomosis with the arteries of the leg, is further supplied by the *profunda perforating* arteries receiving their means of anastomoses along the back of the thigh with the *sciatic*, and the terminal branches of the *circumflex arteries*. Sometimes, the branch of the *profunda* which accompanies the great sciatic nerve, much enlarged, and anastomosing with the *profunda* arteries, issues in the *popliteal* artery.

Ligature of the Popliteal Artery.—OPERATION.—The *popliteal* artery is reached by a vertical incision in the middle line, from about three inches above the centre of the *popliteal space* and carried down to the extent of four inches (Fig. 8). Dividing the superficial fascia, and *fascia lata*, the *tendon of the biceps femoris* is exposed internally, and the artery is continued cautiously along its *outer* border.

The *internal popliteal nerve* and the *popliteal vein* are seen, particularly the *vein* superficial to, and somewhat to the *outer* side of, the artery.

FIG. 8.





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The *dorsal artery* of the foot c
along the *outer side* of the *tendon*
dividing only the skin, superficial fa
seen *between* this *tendon* and the
digitorum, externally, or which may

Ligature of the

was condemned by Mr. Guthrie, as "difficult, tedious, bloody, and dangerous;" and he proposed a substitute.

Having applied a tourniquet to the femoral or popliteal, an incision, six or seven inches long, is made down the *middle* of the *calf* of the leg, over the skin-wound, as nearly as possible, or leading down to the artery at its wounded point. The *gastrocnemius* and *soleus* muscles must be divided freely, their opposed surfaces being recognized successively as tendinous expansions; the under surface of the *soleus* having been reached, the muscles are held aside with curved retractors, and a thin bluish-white *aponeurotic septum*, between the muscles of the calf and the *tibialis posticus*, comes into view. Immediately beneath this septum the posterior tibial vessels and nerve will be found, lying on that muscle. But, as in the arm, the horizontal process of the aponeurotic fascia which thus separates the superficial and deep layer of muscles, is commonly very indistinct and indeed merely cellular in the upper part of the leg.

FIG. 10.



Scraping away this thin membrane, the artery is ligatured above and below the wounded point, including, probably, the *venæ comites* and some surrounding muscular tissue.

Low down, behind the inner malleolus, the artery can be readily secured by an incision *midway* between the malleolus and the *tendo-Achillis*. (See Fig. 10.) Dividing only the skin, superficial fascia, and aponeurosis, the artery is found with the *nerve* to its *outer* side. By extending the foot, and turning it slightly inwards, to relax the flexor and tibial muscles, the ligature can be at once passed and tied.

The *peroneal* artery may be reached by an incision along the *outer* border of the *fibula*, between it and the *gastrocnemius*. The *flexor longus pollicis* must then be either partly divided or drawn outward, when the artery will be found in the fibres of that muscle and running close *under* the *fibula*. The ligature must be passed as best the Surgeon may be able. This operation, like that on the posterior tibial higher up, is more easily described than done.

the interior of the artery, in part; if some irritating fluid had been injected, a slight lamella of lymph here accumulated, the vessel loses its elasticity. It contracts and forms a plug—*thrombus*, which plugs up the vessel, thus rendering it impassable above and below which the calibre of the artery in this condition is denominated *Adhesive*. The obliteration of an artery may also result from inflammation of the internal tunic—"endarteritis." Inflammation, with the apparent secretion of fibrin into the interior of the vessel, may perhaps occur with a spreading character; but whether the disintegrated fibrin remains, I think, is a matter of opinion. This condition constitutes the *Adhesive* of some authors. Many cases of so-called *Adhesive*, more especially, are really the result of poisoning; thickening and softening of the vessel, with a reddish hue, instead of distinct vascular structure, has been produced soon after death, by the action of arsenic.

Arteritis has more recently been distinguished as a seat of inflammation, as affecting either the inner tunic—*endarteritis*; the outer tunic—*exarteritis*; or the middle coat alone—*mesarteritis*. The first two are far more frequently combined; and the middle coat of an artery.

The Symptoms of Arteritis are referred to the part which it supplies. If superficial, *induration* may be felt also passed under the finger; this hardening of the coats, and coagulation within the vessel, is the result of the inflammation.

CAUSES.—Arising usually from some form of *injury*—a blow, a strain, and, the application of a ligature, or the pressure of a tumour—it is may also proceed from some constitutional condition, apparently *rheumatic, gouty, or a syphilitic* character, in the chronic states of diseases. Some blood condition, probably, representing what is called a broken constitution, seems to be the cause of the diffuse form of *arteritis*,—should it occur. A septic embolus may give rise to acute, *pyæmic arteritis*." (Moxon.) The traumatic and constitutional modes may co-operate.

COURSE AND TERMINATIONS.—(1.) *Absorption* of the coagulum generally takes place, the artery also slowly regaining its natural calibre, and the circulation is fully restored. (2.) Or the coagulum remaining extending, *gangrene*, in the dry form of mortification, supervenes, the artery becoming contracted and obliterated as a fibro-cellular cord. *Gangrene* may be prognosticated, in proportion to the degree of occlusion, its suddenness, and the size of the arterial trunk. Absorption, or transmission of the fibrinous exudation in a state of disintegration, and if secreted, would seem to occur in some cases, and give rise to symptoms of *Pyæmia*. This event is more especially incident to *arteritis*. (3.) From the cellular infiltration, the walls of the artery become softened; and thence give rise to general or fusiform aneurism, or to sacculation in the form of *aneurism*; or *rupture* may occur with hæmorrhage. The deposit is prone to *fatty degeneration*, then known as *atheroma*; and its changes by softening or calcification, also predispose to similar lesions in the walls of the vessel which is affected.

TREATMENT.—Local blood-letting, by means of *leeches* applied in the neighbourhood of the vessel, and *warm fomentations* should be followed by calomel and opium, to prevent fibrinous exudation, and alkaline salines to promote disintegrative solution of the coagulum. Stimulants, in their local influence on the general circulation, might increase the exudation of fibrinous matter within the vessel inflamed, and induce gangrene. Stimulating applications also, as mercurial inunction, to promote absorption of the exudation would be similarly hazardous. The treatment of constitutional condition must not be overlooked.

The treatment of gangrene, medicinally, and with reference to amputation, and also of any pyæmic symptoms, presents nothing peculiar.

Calcification of Arteries and Senile Gangrene.—In the legs, *arteriosclerosis* degeneration of the larger arteries, and *fibrous thickening* of the smaller ones, are accompanied with a more or less inelastic and contracted state of the vessels, and perhaps the *coagulation of fibrin* within them; conditions which, together, produce a partial or complete obstruction of the channels through which arterial blood should be conveyed.

SYMPTOMS.—In either or both legs, *numbness, coldness, and weakness* experienced from a defective supply of arterial blood; these symptoms are constant and go, being present whenever circumstances demand a more active circulation, which the unyielding arteries cannot allow; absent when a sluggish circulation is sufficient. Thus, rest, posture, and warmth may maintain this sufficiency; while active exercise, and any constriction or pressure that further impedes the circulation, is soon attended

disclosing the true skin in the
enclosed with a dusky red line.
slowly, extends over the toes an
asymmetrically, followed up by the
accompanying pain is usually severe
up to the instep, senile gangrene pa
were thrust into a black slipper to
dead part is black, shrunken, and
gangrene. If both feet be affected,
It spreads to a variable extent; gain
to the consequent constitutional depe
as high as the knee, or even to the th
predicated, the causative condition of
its extent. The accompanying caus
the typhoid type. Rarely, senile gan
case having been seen by Billroth.

CAUSES.—The inelastic, and con
arteries, is frequently a predisposing
ing the gangrene when established.
abrasion, scratch, or wound—is con
gangrene being so far traumatic. The
and power of accommodation, the gre
inflammation is withheld, and the pu
disposing cause, in virtue of degenera
common with other textures and organ
ossific degeneration of the arteries is
middle period of life, say fifty years o
or in those who are prematurely old f
to this degenerative change, though p

The *duration* of senile gangrene
a few weeks or months, even
limited.

even the laying open of a sinus on the foot, if the patient has been subject to premonitory symptoms.

The treatment of senile *gangrene* is both local and constitutional. The local indication is this: to solicit the formation of a line of demarcation or limitation of the gangrene, and thus also restrict the extent to which it might otherwise have spread. Consequently, means must be taken to maintain the temperature of the foot or feet, in order to diffuse the local circulation and sustain the vitality of the part. *Cotton wadding* or carded wool, in the form of a padding, deeply enveloping the limb, answers most effectually. It need not be reapplied for some days; the gangrenous part being previously wrapped in a fold of lint saturated with chlorinated, carbolic, or other antiseptic lotion. Carbolic oil answers even better than lotion, which is apt to dry. Or an ointment may be used, consisting of resin ointment with creosote. During the process of separation, closure of the vessels, by adhesive inflammation, should be promoted by poulticing or an epithem of spongio-piline soaked in warm water. When the soft textures are detached, the bones may be sawn through, and the otherwise natural amputation aided by this amount of surgical interference. Any earlier or more actual amputation would occasion some hæmorrhage, or might excite inflammation, and thus perhaps start the gangrene afresh. The ulcer left by the part removed, is a simple or healthy, healing sore. Therefore, during granulation and cicatrization, water-dressing may suffice, or a slightly stimulant lotion, as of Friar's balsam—the compound tincture of benzoin, a drachm, diluted with two ounces of mucilage.

Constitutional treatment will depend on the stage of the disease. During the *typhoidal* fever consequent on gangrene, prior to closure of the vessels, supporting measures are indicated; an easily assimilated diet of principally animal food, with malt liquor, and wine or alcoholic stimulants. *Bark*, *ammonia*, and chlorate of potash may be given as a medicinal tonic and stimulant. *Opium* is peculiarly efficacious; the tincture in small but repeated doses, to the amount of two to four grains in the twenty-four hours, and increased as the system is brought under its influence. But the supervention of headache or any disturbance of the digestive organs would suggest its discontinuance; even then, the hypodermic injection of morphia offers an advantageous substitute for its internal administration.

years advance. Sex seems to have some influence; for a varicose state of the veins is produced more frequently in women; probably, chiefly, in connection with the uterine conditions of pregnancy or the formation of a tumour. *Disorders of menstruation* have, apparently, some causative relation to venous varicosity in the lower limbs; the saphena veins becoming distended and painful at each period, or the seat of vicarious hæmorrhage. Lastly, *injuries*, such as fractures, laceration, burns, are not unfrequently followed by obstruction of the neighbouring venous trunks, either from direct pressure, or from thrombosis; resulting in a varicose state of the veins which span over the interspace within which the injury occurs.

COURSE AND TERMINATIONS.—(1.) Inflammation of the vein is very apt to supervene, and by increasing the liability to coagulation within the vessel, lead to further consequences; persistent œdema of the sub-cellular tissue, and ulceration, forming the *varicose ulcer*. (2.) *Venous hæmorrhage* may ensue, sometimes of an alarming character, in the event of ulceration extending into the vein, or some large branch. Similar hæmorrhage may proceed from attenuation and bursting of a varicose vein.

TREATMENT.—The removal of any cause in operation, as any occasion of pressure or obstruction, will, of course, be the primary rule to be observed.

Palliative measures consist in *rest, elevation* of the part, and moderately firm, even, and continued *compression* of the veins, by means of bandaging with an elastic roller. Or an elastic stocking may be worn, as another mode of affording support to the enlarged and weakened veins. These appliances relate specially to varicose veins of the lower extremities; but a similar mode of treatment is applicable generally. The treatment of a *varicose ulcer*, which often co-exists with varicose veins of the leg, is described in connection with Ulcers.

Radical or Curative Treatment consists in obliteration of the Vein or Veins, by various operative procedures. They are none of them more than occasionally successful, and some are hazardous rather than curative.

The *twisted suture* may be applied at intervals along the course of the vessel; with *subcutaneous section* of the portion of vein included between any two such sutures, placed about one inch apart. The subcutaneous section is made with a fine narrow-bladed tenotomy-knife—straight or curved, as may be convenient. The point of the knife is entered under the vein, and carried to the opposite side to just beneath the skin; then, by drawing the blade outwards, so that the point traverses a semicircle under the integument, as felt by the forefinger of the other hand, the vein is thus divided, its thickened structure cutting with a leathery resistance. Pressure with the forefinger upon the edge of the blade, answers better than an actual cutting movement of the knife outwards. And, any risk of thus penetrating the skin may be avoided, by dividing the vein with a blunt-pointed tenotome,—after puncturing the skin with a sharp-pointed knife, just to enter that instrument, as in performing tenotomy. This is the most successful and least objectionable mode of obliterating varicose veins. In no case, but one, have I seen any untoward event—sloughing, phlebitis, or pyæmia;

bleeding may be stopped temporary pressure with the point of the finger, or permanently arrested by a compress applied to the aperture in the vein, with elevation of the limb.

Phlebitis.—Inflammation of the vein produces structural alterations in the vessel, resulting from inflammation of any kind, *Suppurative*, but more commonly from *Arteritis*. These are far more common than *Arteritis*.

The coats of an inflamed vein become thickened and pulpy, owing to increased *fibrinous exudation* and infiltration. In particular, presents this hue—purple matter from the blood, and a lustrous surface. The blood within the vessel is more or less perfectly, forming a hard or soft mass, the *fibrinous exudation*. Thus far the process is readily secreted within the *coats* of the vessel, soon be established. *Diffuse* phlebitis is more common, but as this condition is probably not the distinction seems unnecessary.

The **SYMPTOMS** of Phlebitis are readily affected, and to the circulation in the vessel, *hard, cord-like*, and *knotted* under the finger; and a *purplish redness*, with tenderness perceptible in the course of the vessel. In the condition not uncommon—these symptoms are superadded. In the limited or circumscript abscess in exchange for those of pure *small fluctuating swellings* appear in the vessel, its previously uniformly hard, cord-like more knotty—hard here, and softened there. In the purpuration, the whole vessel is affected.

all the tributary veins throughout the limb. Its cellular texture being gorged with serum, the whole limb is swollen, tense, and hard; polished, pearly white colour, or mottled, cold and insensible—a limb, and much larger than its fellow.

The general symptoms are those of inflammatory fever, very shortly passing into prostration, and pyæmia, as a consequence of diffuse suppurative phlebitis.

CAUSES.—Some form of injury is, commonly, the immediate cause of phlebitis; a wound, as in operations involving the veins, phlebotomy, application of a ligature. But some constitutional or blood-disease probably predisposes, or may be the predominant cause, in some cases. This causative condition is apparently akin to that of *gout*, or, sometimes the *gouty* diathesis prevails. Having regard to etiology, phlebitis is thus also distinguished as *traumatic* and *idiopathic*.

COURSE AND TERMINATIONS.—(1.) *Absorption* seems to prevail in some cases, the coagulum becoming centrally pervious, and a channel thus formed, through which the venous circulation is re-established. (2.) If obstruction continuing, the vessel becomes impervious, and, shrivelling into a fibrous cord, is obliterated; *gangrene* threatens; in proportion to the degree of occlusion, its suddenness, and the size of the venous trunk.

Such are the consequences of *Adhesive* phlebitis, more especially, if the disease is extensive. *Adhesive* phlebitis often proceeds to further consequences, local and constitutional:—(3.) *Rupture* of the vein, with the formation of abscess, and surrounding cellular texture, and sloughing. (4.) *Pyæmia* is attended by rigors, great prostration, rapidity of pulse, with other signs of purulent infection; followed frequently by a fatal issue.

TREATMENT.—The limb must be placed at rest. *Local blood-letting*, by means of leeches applied along the course of the vessel, and *warm applications* may prevent adhesive phlebitis, by promoting resolution of inflammation before fibrinous exudation and coagulation have supervened.

Subsequently, *alkaline salines* seem to induce disintegration and absorption of material occluding the vessel. But the administration of *opium* and *opium* is of doubtful efficacy.

If the disease arising, it must be opened forthwith; and *chronic œdema* of the limb, restrained by bandaging, or removed by blisters. *Stimulants* are indicated, and earlier, than in *Arteritis*; and they are less objectionable in relation to *gangrene*, which is rather a tendency only of the disease, usually resulting from venous obstruction. *Tonics*, in the form of *iron* and *iron*, may be administered with advantage. In cases of *gouty* origin, the treatment should be modified accordingly. The disease will rarely yield to any known remedial measures. Besides treatment by *opium*, wine, or brandy and egg mixture, freely administered, the tincture of the muriate of iron may be given, in doses of \frac{ss} every four hours.

THROMBUS—Thrombosis or Thromballosis.—The term *Thrombus*, signifying a blood-clot, is applied to a clot formed within a blood-vessel—whether an artery or a vein—during life; thus giving rise to *arterial thrombus*, as after the ligature of an artery, or to venous thrombus, after the wound of a vein, for instance, by venesection. But venous thrombi are more common in connection with disease. *Thrombosis* is

Embolism.—The friable thrombus which results from softening of a blood-clot within a vein, is ready for disintegration or disruption into fragments of variable size, any one or more of which shall be transmitted by the blood-stream through other veins into parts perhaps remote, until reaching vessels too small for their onward passage, the fibrinous fragments there become impacted; this process of fibrin-transference and impacted state of the vessels is known as *embolism*, and the impacted fragment is named an *embolus* or *embolon*. These terms are, however, applicable also to a similar history of a thrombus-fragment in the arteries, which are thus subject to embolism; and an embolus may be any other foreign body, as a bit of atheromatous or calcareous matter.

SYMPTOMS.—In whatever portion of the *pulmonary circulation* the vessels are thus suddenly blocked up, the deprivation of blood is attended with more or less urgent dyspnoea and a fit of coughing, as the immediate symptoms of pulmonic embolism. In *other organs* or parts an impacted embolus gives rise to different symptoms, according to the functional disturbances induced; in a *limb*, for example, sudden pain or numbness will be experienced, and the part becomes cold and enlarged with cedematous swelling, below the seat of venous obstruction. When, as often happens, an embolus has hitched upon the bifurcation of an artery, it may incline for a time to either offshoot alternately, with alternating symptoms of obstructed circulation in the parts supplied. Thus, at the bifurcation of the abdominal aorta into the two common iliacs, an embolus may occasion symptoms in either lower limb, from side to side, as the obstruction turns towards either iliac artery.

Embolie deposits of puriform fibrinous matter in the capillary vessels may give rise to *metastatic abscesses*, e.g. in the lungs and other organs; preceded by, and accompanied with, the symptoms of pyæmia, or purulent infection of the blood. Yet it should be remembered that *pyæmic* infection, so called, is only one of the possible events in the vital career of Thrombus.

The Treatment of Thrombosis and Embolism will, of course, be as widespread as their pathology, chiefly in connection with wounds of arteries and veins, and of arteritis and phlebitis, so named.

LYMPHATICS AND GLANDS.

CHAPTER XXVI.

LYMPHATITIS.—ADENITIS.—TUMOURS.

Lymphatitis.—Inflammation of the Lymphatics, *Lymphangitis*, or *Angeioleucitis*.—The walls of the lymphatic vessels, when inflamed, are thickened and softened, the surrounding cellular tissue is infiltrated with fibrinous exudation, and the capillaries are injected.

and beset with a *spongy swelling*, *burning pain*, and *tenderness* on the part of the vessels. These symptoms when the lymphatics are affected, and may be distinguished from those of the lymphatics are principally the *swelling* of the superficial lymphatics on the flexor side, being seen coursing up the front of the arm to the axillary glands, or along the thigh to the inguinal glands. *Suppuration* rarely extends, in the limbs. *Suppuration* symptoms of abscess, or by those of this condition prevailing. Considered as a whole limb—supervenes, as the venous condition is more intense with the lymphatics. The *general* symptoms will be exchanged for *prostration*, or sinking.

DIAGNOSIS.—1. As distinguished from the recognized by the absence of the *characteristic* purplish streaks, and by the presence of the which they lead. The arborescent lymphatics differs from the distribution of inflammation to a simple limitation of inflammation to a simple however, a plexiform arrangement of the differential character is lost. 2. In lymphatitis might be mistaken for *erysipelas* redness—unlike the ramified streaks of rose colour, and is unaccompanied by the boundary also of the patch of inflammation in both diseases, the inflammation is of a diffuse character. Considered as always traumatic; originating from a

In persons of a broken constitution, and those who are in a low state of health, inflammation of the lymphatics readily occurs, and often from scarcely perceptible external causes; the pressure of a tight boot, inducing a few reddish streaks on the inner side of the leg and thigh, with swelling and tenderness of the inguinal glands; or a slight abrasion on the hand being followed by similar inflammation of the lymphatics along the inner side of the arm, extending to the axillary glands. The association of erysipelatous patches with the linear streaks of lymphatitis, would bespeak a constitutional condition of that kind.

COURSE AND TERMINATIONS.—(1.) *Resolution* takes place not unfrequently, even in those who seem most susceptible of the disease. The reddish streaks fade away, and the œdema subsides. (2.) Or, inflammation having ceased, *indurated cords* may remain, with brawny swelling, for some time. (3.) Suppurative lymphatitis often leads to the formation of *abscesses* in the surrounding cellular texture, and possibly sloughing. (4.) *Pyæmic infection* is a frequent consequence, proceeding, probably, from the direct transmission of pus from the interior of the vessels.

TREATMENT.—The application of a few *leeches*, along the course of the vessels, may be appropriate in the absence of an erysipelatous tendency; but *warm fomentations*, elevation of the limb, and rest will always be suitable, and generally prove sufficient to reduce the inflammation. Alkaline salines and other mild depletory measures are auxiliary at an early period.

Abscesses should be opened without delay, and *chronic œdema* is best overcome by careful bandaging and blistering, or the application of mercurial ointment. *Stimulants* will soon become requisite in the course of this disease. Wine, brandy, and ammonia must be freely administered; the latter, I think, has a depressing influence, when continued for any length of time; and any stimulant supplies only a prop, to be withdrawn in proportion as nourishing food can be taken and assimilated. The treatment of *pyæmia*, as a consequence of lymphatitis, presents nothing peculiar.

Inflammation of Lymphatic Glands.—Adenitis.—Inflammation of the lymphatic glands is attended with some thickening of the conglomerated vessels, and infiltration of the interstitial cellular tissue with fibrinous exudation and cells, but seldom with any permanent obstruction of the interior of the vessels. Suppuration not unfrequently takes place, forming an abscess, either centrally in the substance of the gland, or in the external and surrounding cellular texture.

The **SYMPTOMS** are simply those of ordinary inflammation; the gland becomes *swollen, hard, and painful*, with, perhaps, a blush of redness and heat in the superimposed integument. Induration is less notable, owing to the naturally firm consistence of the lymphatic glands; but they may acquire even a bullety hardness, as the inguinal glands in connection with an indurated syphilitic sore. Softening often succeeds in ordinary adenitis; and with suppuration, the usual symptoms of *abscess* supervene. Œdema commonly occurs in the part below, and proportionately as absorption becomes obstructed. The constitutional disturbance is the inflammatory type of fever, and often more acute than with inflammation of the lymphatic vessels.

CAUSES.—Usually ensuing as a continuation of inflammation along the

lymphatics, adenitis sometimes arises independently, from an injury from *absorption of noxious matter*, not affecting the intermediate vessels. A sprain or an ulcer may thus induce inflammation of the glands distant from the seat of either; as the inguinal glands, when the foot or leg is the source, the intervening lymphatic vessels remaining unaffected. But inflammation of the lymphatic glands may also proceed from constitutional conditions; as *scrofula*, and *syphilis*—in the form of bubo.

COURSE AND TERMINATIONS.—(1.) *Resolution* occurs in many cases of ordinary inflammation. (2.) *Chronic enlargement* and induration is uncommon. (3.) *Suppuration* may be followed by sloughing, and exposure of the glands, as reddish-grey, soft, spongy, and perhaps pediculated masses, notwithstanding the destruction around them. This is seen in an open chancroidal bubo.

TREATMENT.—Leeches are seldom necessary; *fomentation, rest, relaxation by position* generally being sufficient to resolve the inflammation, aided by mild depletory measures medicinally. *Suppuration* threatening, the same treatment should be continued, and warm opopline fomentations or poulticing having been assiduously employed a few days, a bistoury should at once be introduced, and any matter free ere burrowing has taken place. Fistulous tracks are more apt to heal with suppuration around the gland; and stimulating injections of nitrate of silver will then, perhaps, succeed in exciting healthy granulation so as to close these passages; failing which, they must be slit up and healed from the bottom. *Chronic induration* of the lymphatic glands is best dispersed by the occasional application of iodine paint; but if suppuration has taken place, and perhaps circumferentially, with fistulous openings through which portions of the glandular mass protrude, it is requisite to destroy such a mass by introducing a stick of caustic potash into its substance and turning it freely about. Thus also induration may be dissolved. A stimulant and tonic plan of treatment must take the place of any depletory measures, during suppuration, chronic induration; and removal of the latter may, perhaps, be aided by iodide of potassium in conjunction with this treatment.

Extirpation of the lymphatic glands in a state of chronic induration may be the only means of cure. But so long as they remain quiet the indolent tumours had better be left alone, in most cases, for complete removal may often lead to a greater depth of operation than the external appearance would indicate.

Enlargements, and Tumours of Lymphatic Glands.
Lymphoma, or Lymphadenoma.—The term Lymphoma is applied to a class of tumours which in structure resemble that of the lymphatic glands. Commonly, this form of growth consists of *chronic enlargement* or hypertrophy of the lymphatic glands themselves; but, associated with this condition, there are often a number of similar growths, in the form of distinct *tumours*,—beyond the normal number of enlarged glands having the lymphatic structure. Lymphomatous tumours may also arise in parts of the body unconnected with the lymphatic glands: as in the spleen and liver, lungs, kidneys, stomach and intestines, bone, in subcutaneous cellular texture, and in other organs and tissues. A *disseminated* condition of Lymphoma or of Lymphadenoma, as

growths are termed, constitutes "Hodgkin's disease." But the lymphatic glands are commonly first affected, by the overgrowth of the lymphatic tissue, followed by its formation in parts which are previously devoid of such tissue.

The characters of lymphoma are similar to those of scrofulous enlargements of these glands,—as already noticed among the numerous local manifestations of Scrofula; but for accuracy of description I shall follow the account of lymphoma. For a long time the glands preserve their original shape, and remain isolated, although clustered. Continuing to increase, these glandular tumours unite and form a *lobulated mass*, of a soft and *elastic* consistence; tender perhaps, but *scarcely painful*. The growth may then be arrested, and the conglomerate mass remain; causing more or less compression and functional derangement of the adjoining organs; or the tumour may slowly pass into caseous degeneration, with rupture of the integument. All the lymphatic glands are not equally affected to this disease; usually the *cervical*, less frequently the axillary and inguinal, most rarely the abdominal, the bronchial, and mediastinal. One or more glands may be affected; and not unfrequently conglomerated masses or masses are formed in *different parts* of the body.

In removing a lymphomatous mass, the consistent tumours are usually kidney-shaped or ovoid; and on *section* exhibit a greyish-yellow colour, which by exposure assumes a reddish hue. The minute structure of these glandular tumours consists of an accumulation of lymph-cells, which have undergone proliferating development; with atrophy and destruction of the enclosing capsule and trabecular structure, which, in the form of a fine open fibrous network, contains the lymph-cells. The cells are larger, and more abundant, in proportion to the rapidity of the growth; and thus, in slow-growing lymphoma, the reticular matrix, which may be even increased to fasciculi, forms the greater portion of the growth. The blood-vessels remain, but their walls are much thickened.

Thus the proper structure of the gland is destroyed. The cellular reaction may be so considerable, as to resemble a *gliomatous* tumour. The pinkish-grey colour and cerebral softness of the tumour—when the growth presents more often the characters of *encephaloid cancer*; denser and slower-growing lymphoma resembles an *enchondromatous* tumour.

The *origin* of lymphoma is hardly ever congenital; but the tumour may occur from the first to the sixtieth year; usually, however, between the first and twenty years of age, and rarely after thirty. Some connection may be traced between lymphoma and leucocythemia, or an excessive development of white corpuscles in the blood,—white-celled blood. How refers leucocythemia, in such cases, to the excess of white cells supplied by the hyperplastic lymphatic glands. Billroth differs from this opinion; for with extensive tumours of the lymphatic glands, leucocythemia rarely occurs; and the glands being more or less completely destroyed, it is improbable that their functional activity should thus be increased. The disease—according to Dr. Gowers—occurs three times as frequently in *males* than in females; and the period of lactation is supposed to have some predisposing influence. *Local irritation* is often the exciting cause. In the course of the disease, sometimes, the growth is arrested, the glandular enlargement diminishes before death. The

average duration of lymphoma is under *two years*; death occurring usually from *asthenia*.

Another form of lymphoma is also recognized by some pathologists in which, with the same essential structure, the growth proliferates rapidly, and infiltrates the surrounding textures; the tumour appears as a *fungoid* mass, and having a malignant character. These medullary lymphomatous tumours always recur after removal, and are almost always fatal.

TREATMENT of lymphoma in its ordinary benign form is much the same as for scrofulous enlargement of the lymphatic glands. Constitutional measures are more efficacious than topical applications. The patient's general health must be brought under the influence of iron, quinine, or arsenic, cod-liver oil, and a nutritious diet; reinforced by a hygienic régime of good air, such exercise as the strength can bear, and other invigorating resources. Iodine, of more remedial value when used externally, may be applied, as iodine paint or ointment, with some hope of thus reducing the size of a lymphomatous tumour. Its removal by operation will scarcely ever be advisable, whether on account of the extent and ill-defined nature of the mass, or the situation in which it may be placed; as occupying one or both sides of the neck, or the side and side of the chest. Sometimes the tumours may be shelled out and enucleated with the fingers; in other cases, where the mass is congenitally large and softened, a considerable dissection will hardly succeed in separating the whole. Here, also, the growths are apt to return; and even the apparent success of the operation may ultimately be defeated.

BONES.

CHAPTER XXVII.

FRACTURES.

Fracture is a solution of continuity of the osseous texture, suddenly produced, and by some degree of external violence, or perhaps internal action; the broken ends of bone being more or less contused or lacerated by the act of breaking. Fractures differ essentially in regard to the mode of their reparation, according as they are unaccompanied or attended, by an open wound communicating with the fracture; the former being termed *Simple*, the other *Compound*. *Complicated Fracture* is another recognized distinction; when the injury to the bone is accompanied with injury to other parts, as important blood-vessels or nerves, an internal organ, or extends into a joint, or is accompanied with dislocation.

But any such additional injury is not an essential condition, as pertaining to the pathology of Fracture.

In its extent, a fracture generally passes completely through the bone—*complete* fracture; occasionally, it is limited to part only of the whole thickness of a bone—*incomplete* or, as it is sometimes aptly termed, “green-stick” fracture. In direction, the line of fracture may be *transverse*, *oblique*, or *longitudinal*, as compared with the axis of a long bone. If there be more than two, perhaps several, fragments, the fracture is *comminuted*. *Impacted* fracture is that condition wherein one fragment is wedged into another, the compact structure being driven into the cancellous texture. An aperture made through a bone, as by a ball in gunshot wound, is sometimes named a *perforated* fracture.

Generally, *displacement* of the fragments, in some degree, occurs with fracture; or subsequently, by muscular action or the weight of the limb. Displacement may be *transverse*, *oblique*, *longitudinal*, *angular*, or *rotatory*, as compared with the axis of a long bone; or a depression, in the flat bones of the skull.

Separation of the *epiphysis* is liable to occur, at the extremities of long bones, as the ends of the humerus, and the lower end of the femur, and tibia; or the various epiphysal processes, as the olecranon and the acromion, may be detached. Fracture of this kind takes place at the line of junction between the epiphysis and the shaft, or the body of the bone. Hence its direction is *transverse*. Such fracture is possibly only before the completion of ossification, and perfect continuity of the bone; during, therefore, infancy or youth, or probably not later than about twenty-one years of age.

SIGNS.—Fracture is attended with (1) *mobility* of the broken portions of bone, and (2) *crepitation*, a rough grating sensation, felt and heard, when the broken surfaces are gently moved in contact. Usually, the (3) *normal outline of the limb* is altered, by the displacement of fracture and the speedy supervention of swelling, a disfigurement of *contour* which the experienced eye will frequently recognize at a glance; and there is more or less (4) *elevation or depression*, also by the displacement and swelling at the *immediate* seat of fracture. Here also there may be more or less bruised discolouration of the integument, owing to extravasation of blood, especially in fracture from direct violence; or some inflammatory redness may have supervened. Blebs or little bladders of reddish or yellow serous effusion, not unfrequently arise near the seat of fracture. They do not necessarily indicate a tendency to gangrene; but often subside, the fluid being absorbed, or burst and disappear. (5) *Shortening of the limb*, in some degree, takes place when one of the long bones, as in either limb, is broken; and this resulting from the involuntary contraction of the muscles acting on the lower fragment, it takes place invariably, excepting in transverse fracture, without displacement, or when one only of two companion bones is broken, in the leg or forearm. *Impacted* fracture is accompanied with less shortening than when the fractured ends are free. Pain, and inability to use the limb, or broken bone, are *functional* symptoms of Fracture; but of equivocal value in aid of **DIAGNOSIS**.

Fracture is attended with *shock*, in a greater or less degree, followed by reaction; or, if the latter be accompanied with exhaustion, a mixed state of prostration with excitement *supervenes*, constituting *traumatic*

predisposing conditions, as the exposed example—and brittleness of the osseous on age. Separation of an *epiphysis*, as a is a species of fracture incident to youth apparently have some predisposing influences, rickets, syphilis, cancer, scrofula, and scurvy.

REPARATION.—Fracture is disposed to process of primary adhesion, namely, by a process of union, unaccompanied by inflammation. Lymph, in small quantity, is first exuded rendering the cellular texture more succulent, swelling, which, however, is partly or partly extravasated by the injury. This mixed swelling of lymph not continuing later, in the first or third day. A period of inactivity—"of uncertain duration, but which, in the adult, is more than two. Then the proper reparative process begins to flow. A layer of this lymph is deposited between the fragments of bone, which, undergoing development, changes into cartilage, and thence, in the process of ossification, forms a bridge of the continuity of the fragments; forming a layer of bone—an "intermediate callus." If the ends be in even apposition or overlap; the intermediate callus extends into the interval to unite portions of bone which would otherwise be separated. Neither an "external" nor an "internal" callus is formed in the human subject, as was formerly supposed. A fractured limb or part is subjected to unusual use, or when the original bone is deformed, the forming callus may be thrown out around the fragments as with a bony clasp, and forms a medullary canal.

Separation of an *epiphysis* readily undergoes reparation by osseous union.

Ligamentous union only takes place where, apparently, the vascular supply is insufficient for osseous repair; *e.g.* in fracture of processes of bone, as the olecranon, and coronoid process of the ulna; or within a joint, as intra-capsular fracture of the neck of the femur; or where the fragments are not retained in apposition, as in transverse fracture of the patella.

The fracture of *cartilage* is, not unfrequently, repaired by *bony union*. Thus, a costal cartilage—although much less often fractured than a rib—united in the same way; by an intermediate callus of bone, with an external or ensheathing bony callus—as a provisional or temporary support, giving to the mobility of the ribs, during the ossification of the intermediate bond of union.

The *period* for the completion of fracture-union is uncertain. The average period for the production of firm, and therefore apparently ossific, union may be said to vary from *six to eight weeks*; soft union taking place in a shorter period, and during *childhood* in perhaps a *week or ten days*. Generally, the process of repair is more speedy in the upper extremity than in the lower limb.

Various adverse conditions, of a persistent character, may severally tend to *retard or arrest* the *formation of callus*. Causes predisposing to fracture have this additional effect. Such, perhaps, are *age*, and certain *Mood-diseases*; *e.g.* rickets and mollities ossium, syphilis, cancer, scrofula, and scurvy. Exception may, I think, be taken to the alleged *mal-influence* of rickets. Other causes, not predisposing to fracture, have, perhaps, the same tendency to prevent union. Such are *febrile disturbances*, erysipelas, starvation, pregnancy; and certain *local conditions*; a muscular action, frequent movement of a fractured limb, the direction of fracture as facilitating the recurrence of displacement, and the interposition of a piece of muscle, or dead bone, between the fragments.

TREATMENT.—Immediately after Fracture, the occasion for Surgical interference is urgent. The hard and rough portions of bone, subject to the action of muscles, or other movement, are apt to lacerate and bruise the surrounding textures. This state of the part is more provoked by fracture accompanied with displacement, and when the broken ends of bone are pointed, as in oblique fracture. Hence arises increased and continued pain, spasm of the muscles, hæmorrhage and tension; or inflammation, advancing so far as to prevent the formation of reparative lymph at a subsequent period. Compound fracture may be produced, by either fragment piercing the skin. Shock also, which would have been slight and transient, is perpetuated.

The subject of the accident should not be moved unnecessarily. If a lower limb be the seat of fracture, it is important to wait until a suitable conveyance can be procured. A litter is best fitted to carry the person, without any jerking movement, which would inevitably damage still more the already injured soft parts. Hence, also, the limb should be properly secured, by tying it to its fellow, during the journey, however short, to an hospital or to home. The dress must be cautiously removed, and particularly from off the fractured limb, by ripping up the clothes. It may be advisable to aid the *vital powers* in recovering from the

shock of injury, by the administration of stimulants; wine, brandy ammonia.

The analogy of simple Fracture to an incised Wound, as a scientific textural continuity, at once suggests the two Rules of Treatment, followed without delay.

(1.) *Reduction and Coaptation*, or the adjusted apposition of fractured ends of bone. This condition implies a *suitable position* of limb, to relax, as far as possible, any antagonistic muscles, which their spasmodic action, retain the fragments in a displaced position; also implies some *extension* of the limb, with *counter-extension* or resistance, sufficient only to bring the fractured ends of bone parallel to end; a procedure which is designated the "reduction" of Fracture. *Coaptation* or "setting" is then readily effected.

(2.) *Maintenance of Coaptation* during the process of repair including the solidification of the callus. This still presupposes a *position* to prevent redisplacement by the spasmodic action of antagonistic muscles. But it also implies the employment of *retentive appliances*, or *retentive apparatus*; and *both*, to insure *rest*. This is, obviously, only the continued fulfilment, and completion, of the former rule of treatment.

If the fracture be *incomplete* and the bone only bent, as happens sometimes in young children, reduction should not be accomplished at once, but by degrees; each adjustment being secured by a *retentive appliance*, placed so as to oppose the recurving of the bone as in some cases of fractured clavicle, or broken tibia.

Splints of wood, pasteboard, leather, gutta-percha, plaster of gum and chalk, or metallic splints, and bandages, constitute the *retentive appliances* generally employed.

No *medicinal* treatment or scarcely any of a constitutional character is, usually, required in the course of simple Fracture. The shock of injury having passed off, the healing process goes on without appreciable troubling the general functions of the body; and they, in turn, take no notice of the local process. *Diet* should be adapted to the *hygienic* condition of the individual, now disabled for business pleasure; and, more particularly, it should be proportioned to the *process* of reparation. At first, therefore, moderate and comparatively *trititious*, the diet must soon be more liberal and nutritious. *Laxatives*, just to regulate the bowels, are needed not unfrequently, the patient is confined to bed; but active purgatives are, by their *action*, apt to occasion disturbance of the fractured part, and so peril the *process* of union.

In due time—a period varying considerably, according to the *age* and health of the individual—any retentive appliance may be *finally* removed with safety. The fracture must then be gently *tried*, to test its *strength* by passive motion of the limb. If firm union has taken place, the functions of the limb should be as tentatively resumed. In fracture of the lower extremity, this trial of power should be made *very* gradually, for, if worked too soon, the limb shortens under the weight of the *limb*, and permanent crippling is the result. *Edema*, in some degree inevitable, when first the limb is allowed to be free and pendent. *Frictions* will aid in restoring the circulation; and a *light* and

gives support to the flesh, as yet flabby. Prolonged confinement, however, would tend to permanently waste and weaken the

Compound Fracture.—Compound Fracture is, essentially, Fracture, with a wound in the skin *communicating*; thus exposing the seat of the injury, however indirectly, to the action of the air. The structural disarrangement, as regards the state of the bone, is the same as in simple fracture; but compound fracture is usually accompanied with more severe contusion or laceration of the surrounding soft textures. This condition, combined with that of the aperture externally, which is also contused or lacerated, together form a Contused or Lacerated Wound, *connected with, and communicating with, a Fracture.*

SIGNS of this injury are the same as those of simple fracture, with the additional and distinctive character of an external irregular wound. Therefore, both the condition and characters are those of simple fracture, *plus* those of contused or lacerated Wound.

CAUSES, AND EFFECTS OF COMPOUND FRACTURE.—External violence is usually the cause of the wound in the skin and subjacent soft parts, as of the connected fracture; which may then be regarded as an extension of the injury from *without*. Or the fractured bone may itself penetrate to the surface and through the skin; the wound being an extension of the injury from *within*. In the one case, the force is applied *directly* to the seat of fracture, and the injury is more a *contusion*; in the other case, the force is applied *indirectly*, to the bone at some distance off, and the injury is more a *laceration*, and less severe. In both cases, the contused or lacerated textures are damaged to the apparent extent of injury; and the *shock* to the nervous system is more severe than with simple fracture, owing to the greater injury to the soft parts, including nerves. *Tetanus* is, perhaps, more liable to supervene than after a contused or lacerated wound alone, and especially if the compound fracture be oblique, and movable among the soft parts and muscles. The textures injured, being in a state of disarrangement, die, at least to some extent around; if the wound be allowed to remain open. This purely *traumatic* gangrene is the same as that produced by a contused or lacerated wound. *Limited*, therefore, to the part injured, and defined, eventually, by sloughing, or by a line of demarcation between the living and dead textures, the gangrene is *immediate* also, if the injury itself be severe.

COURSE, AND TERMINATION.—*Inflammation* supervenes, followed by suppuration, perhaps profuse, and partial sloughing; or by gangrene, of a larger scale. Either degree of mortification, arising from inflammation, is *limited* to the seat of injury. By this process, however, a fracture, originally simple, may become compound in some cases. *Extensive* gangrene—due to some morbid condition of the blood—supervenes on compound fracture, only as an occasional contingency; and its phenomena have been already described in connection with the course of contused and lacerated wounds.

REPARATION.—But the tendency of compound fracture, when reduced, is to undergo *reparation*; union of the fragments taking place, either through the medium of dense *connective* or *fibrous tissue*—an imperfect union, or through a *bony callus*, with firm consolidation, as in simple

fracture. The wound in the soft textures closes up and heals by suppurative granulation and cicatrization. Under other circumstances, union of the fracture is effected by ossifying granulations. Thus, if the bone, when reduced, be *exposed*, in an open suppurating wound—say, the fractured ends of the tibia—*granulations* may form on either end, and meeting together, coalesce, constituting a soft callus, which becomes *ossified*. When a portion of the bone dies, whether as the result of contusion or comminution, or having been laid bare by sloughing, or isolated by burrowing suppuration around the bone, the dead portion is slowly detached, by the process described in connection with *Necrosis*,—the detached piece being named an *exfoliation*, or a *sequestrum*; then, the subjacent granulations springing up more freely, form the callus, which is transformed into new bone.

The *histological* process by which bone produces granulations, consists of the following changes, as demonstrated on or in a denuded portion of bone, e.g. the tibia. 1. At about the end of *ten days* the bone, which had hitherto a yellowish colour, assumes a bright red tint, having become more vascular. The surface is beset with a number of red points, or little streaks; they are the young granulations, which rapidly growing in height and breadth, spread and coalesce, so as to present a mammillated granulating surface, continuous with the granulations of the surrounding soft textures. The *Haversian canals* are crowded with small round cells—apparently *emigrated white blood-cells*—which *infiltrate* the *connective tissue* along the walls of the canals, and the included *blood-vessels* have developed into vascular loops; this infiltrated tissue, together with the looped vessels, growing to the surface of the bone, sprout out of the open ends of the osseous canals, in the minutely punctiform appearance of the young granulations. 2. The canals themselves at first become *atrophied* and *enlarged*, by absorption of their walls, to make room for the cell-infiltration, and thus the granulating bone appears porous, when macerated to remove the out-cropping granulations. 3. *Ossification* of the granulation tissue proceeds rapidly within the bone, so that the osseous texture soon loses its porous character, and becomes denser and harder from the interstitial deposit of new bone. Between the fractured ends, ossification takes place far more slowly, leaving the callus a soft, fibrous connective-tissue bond of union, for perhaps a long period; while, on the surface of a bone, granulations acquire only the character of a condensed texture, in a cleatrix which, although continuous with the surrounding skin, is firmly attached to the subjacent bone.

Diffuse suppurative periostitis and *osteo-myelitis*, or diffuse suppuration within the medullary canal and cancellated structure of a long bone, may both be mentioned as causes of necrosis in compound fracture. But the necrosis will probably then be so extensive—the whole shaft of the bone perhaps perishing—that these diseased conditions have no practical relation to the union of compound fracture.

The *average period* for union in compound fracture is about twice as long as in simple fracture. Thus, with regard to a long bone, and in the lower extremity, as the tibia, *three or four months* may elapse ere the same degree of firm ossific union is produced. In the event of union being effected by *granulation*, the process is more prolonged; just as in the soft textures, this mode of healing is slower than primary adhesion; and

granulations are produced even more slowly than granulations of simple fractures. When the process is complicated by *necrosis*, the detachment of the dead portion of bone delays the union to the period.

Prognosis of compound fracture, as gathered from a due consideration of the natural course and tendency of this lesion, is far less favourable than that of simple fracture. An *open* wound, communicating with the fracture, as compared with subcutaneous laceration of the soft parts, is one unfavourable ground of prognostic distinction. Scarcely less so is the greater extent of their injury, usually in compound fracture; and if produced by direct violence. Consequently, the chequered course of hæmorrhage, shock, and tetanus; traumatic gangrene, inflammation and its consequences, in suppuration and sloughing; necrosis; erysipelas and pyæmia; have each and all to be taken into account, as being less probable contingencies in considering our prognosis of compound fracture. *Spreading* gangrene is an adventitious condition, yet a most formidable one, as implying the co-operation of a constitutional cause.

TREATMENT.—The same rules of treatment are applicable as for simple

fracture. The reduction of the displacement may present special difficulties. Thus, if both ends of bones *protrude*—whether this condition was produced by the original force of the fracture, or by the sheer weight and pressure of the limb, or possibly by roughly handling—the displacement may be reduced by sufficient extension of the limb. When, however, such displacement is due rather to muscular contraction and spasm, acting especially on the lower fragment, which is thus drawn upward; enlargement of the wound, by *incision*, will be preferable to forcible extension; and the proceeding is the more urgent also, in proportion to the circumferential swelling, from hæmorrhage or serous effusion. With increasing swelling, the protruded portion of bone becomes tightly embraced by the integuments, through which it has passed; a condition frequently witnessed in compound fracture of the tibia, and which strongly suggests the propriety of enlarging the aperture to free the

protruded portion. In exceptional cases sometimes occur. 1. When protrusion arises from the rigidity of the bone, as in rickets, *excision* of a portion of the bone may be necessary to reduce the displacement. Union, firm and perfect, will probably take place, with, or without, the reproduction of bone as an intermediate callus. The limb is ultimately restored to its original length, or remains proportionately shorter than its fellow. 2. More rarely, the protruded portion, although reduced, cannot be retained in place; it may then be advisable to excise that portion to a certain extent for this purpose. But this difficulty can generally be overcome by an altered position of the limb, or by *tenotomy*; as when the lower end of the tibia is tilted forward by traction on the tendo-achilles. 3. *Splinters* of bone have special significance in relation to the treatment of compound fracture, there being an open wound communicating with the fracture. If only partially detached, any such portion of bone may retain its vitality and regain its connection. But if completely detached, the fragment is obviously a foreign body and should be removed; a proceeding the more imperative, when any such fragment intervenes between the

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and *dependent incisions* are necessary, for the easy vent of matter as it forms, and to relieve tension. A *drainage-tube* may then also be used with advantage. Otherwise, the pent-up matter, working its way about the seat of fracture and among the textures around, dissects and detaches the bone, periosteum, muscles, nerves, and vessels; and thus destroying their continuity, the fracture remains ununited, and the parts around become saturated and soddened; in short, an irreparably disorganized limb is the result. Consequently, at a later period, incision may be necessary to remove any portion of dead bone, whether as an *exfoliation* or a *sequestrum*. Compresses of lint, properly applied, will do much to prevent the burrowing of matter; and the pad of dry lint, which closed the wound in the first instance, may now be advantageously exchanged for a poultice, or piece of wet spongio-piline, as a cleaner application, to promote the discharge, for a time. But this should be succeeded by light water-dressing, carbolic-acid solution, or boracic ointment, when the continuance of warmth with moisture would only sodden and relax, and when the wound is granulating.

Hectic fever and exhaustion, consequent on prolonged and perchance profuse suppurative discharge, are best relieved by a diet, consisting principally of animal food, in which albuminoid matters prevail, with wine, beer, or spirits, according to the patient's previous habits. In short, what is termed a nourishing and stimulating diet is most beneficial; the quantity of food being regulated by the digestive power of the individual, and the stimulants proportionate to his previous habits and present exhaustion. Tonics, in the shape of quinine and the diluted nitro-muriatic acid, or other mineral acid, are to be regarded only as serviceable adjuncts. Sleep must be procured by an opiate nightly, when necessary; and restlessness allayed by maintaining the influence of opium, slightly, day by day until the strength is somewhat restored. Careful regulation of the alvine evacuations is a most important injunction throughout the course of hectic fever; any approach to constipation increasing the general irritability. It may, however, often become necessary to check, if possible, the tendency eventually to diarrhoea. The hygienic and medical treatment for the *typhoid fever* arising from gangrene or sloughing, is substantially the same as that for hectic fever.

AMPUTATION.—The "question of amputation" in compound fracture turns upon the probability as to the supervention of traumatic *gangrene*, or of *profuse suppuration*, with perhaps *necrosis*; in either way the limb will be *irreparably* disorganized, and life thereby endangered.

(1.) When the *whole substance* of a limb is involved by the injury of compound fracture, either or both results are *inevitable*; and there is no alternative but *primary*, or immediate, amputation.

(2.) When, however, the extent of damage is itself *partial*, the supervention of gangrene or of profuse suppuration is but *proportionately probable*; the limb is *not* inevitably lost, nor the life surely perilled. Accordingly, the postponement of amputation until the *actual supervention* of either or both these local conditions—in other words, *secondary amputation*—should be the rule observed, in order to give the limb *its* chance of preservation; the safety of life being provided for by *timely* amputation, under these circumstances.

Certain rules, however, as to the *urgency of amputation* are laid down

in surgical works, according to the *extent* of injury to the vessel, etc. Any such pathologico-anatomical conditions have significance in proportion to the certainty or probability of gangrene or suppuration supervening. I here omit the probabilities of hæmorrhage, exhaustion from shock, the occurrence of tetanus, or pyæmia, as being contingencies which cannot be foretold, and which are preventible. But no Surgeon can positively determine amputation should be performed in a doubtful case; guided by that particular extent of injury, and in this or that individual different periods of life also, from youth to age; and as subjected to modifying influence of previous habits. The beneficial influence of aseptic dressings, is an additional factor against primary amputation in Modern Surgery. Thus, many limbs are probably sacrificed which otherwise might be saved.

As a general rule, certain injuries *additional* to compound fracture will *severally* justify the Surgeon in having recourse to primary amputation. 1. When there is extensive laceration or contusion of the parts, with detachment of the skin; and especially, when the main artery of the limb is ruptured, as shown by the loss of pulsation below the injury. Or, when there is extensive comminution with the compound fracture and generally in connection with considerable contusion of the surrounding soft parts. 3. When, again, a large joint is the seat of a dislocation, or a combination of injuries. In the lower extremity, these various complications of compound fracture are more serious than in the upper extremity; and their importance in any case, should be estimated by taking the age of the patient into consideration; the power of recuperation not only being less in the lower limb, but in either limb becoming competent to meet extraordinary demands, as life advances.

Certain other additional injuries affect the question as to the position of the limb to be chosen for amputation. 1. A second fracture, above the seat of a compound fracture—requiring amputation, may admit of an operation between the two injuries, provided the soft parts be sufficiently sound and extensive, for the formation of a stump; otherwise amputation must be performed above the additional fracture. 2. In the same manner, a dislocation above the compound fracture—requiring amputation, may admit of intermediate amputation, or otherwise above the fracture. When either additional injury is itself *compound*, amputation must be transferred to above both seats of injury. But as, in such cases, the limb may thus have to be removed near to, or at, the hip or shoulder joint, the result will then be about equally hopeless, with or without operation. In the upper limb, this proximity of amputation to the shoulder is less perilous than in the lower limb.

Spreading traumatic gangrene, arising from compound fracture, bears the same relation to amputation, as in the case of contused or lacerated wound. The rule of treatment should be: *removal* of the exciting cause by amputation of the limb, *without delay*, and at some *height* above the seat of fracture—no line of demarcation forming in spreading gangrene to indicate the time and part for amputation.

Complicated Fractures.—These injuries follow naturally in the order of description after compound Fracture, which is a complicated form relatively to the simple form of this injury. But the complications

to are any *additional* injury or injuries which may be received *simultaneously* with Fracture, whether itself simple or compound; and *orbis condition*, local or constitutional, which may be connected either lesion as predisposing to its recurrence, or as affecting the of its repair.

1) Fracture may be complicated by association with *injury* to a *artery* or *nerve*, by extensive laceration of the *muscles*, by extending *joint*, or by an accompanying *dislocation*. The danger of any such *dislocation* is especially the increased liability to *gangrene*. This may without an external wound; as from simple fracture, implicating an artery, either by laceration, or by penetration. (2.) Other *conditions* of Fracture may be produced by injury to some special part or *organ*; as fracture of the pelvis implicating the bladder, of the *wounding* the lung or pericardium, or of the skull injuring the *brain*. (3.) Then again, Fracture may be complicated by association *some morbid condition*, local or constitutional. Thus, certain blood-*disorders* predispose to Fracture, and retard or arrest the formation of *callus*. Rickets, mollities ossium, syphilis, cancer, scrofula, and scurvy, have severally this twofold effect; while febrile disturbance, *debility*, starvation, and perhaps pregnancy, severally tend to prevent *repair*. These have been already noticed.

TREATMENT.—Two considerations are of general practical importance *application*, in relation to the treatment of the various complications *of fracture*—simple or compound. Firstly, is the complication any *condition* or *conditions* in operation, locally or constitutionally, affect unfavourably the natural process of *repair*? In this case, *treatment* must be entirely subject to such one or more conditions. *Secondly*, is the complication any *injury* or *injuries*, *additional* to *fracture*? In this case, the treatment of the *fracture* may be of quite *relative* importance, even although it be, as in many such cases, *compound*. But complications of this kind may necessitate *special* treatment, as noticed in connection with Compound Fracture.

DISEASED CALLUS, AND DEFORMED UNION.—These conditions represent unfavourable terminations of United Fracture.

The whole pathology of Diseased Callus is that of Diseases of Bone *callus*; but they may severally be associated with Deformed Union *fracture*.

Deformed Union of Fracture appears in various shapes, according *relative* position of the fragments. (a.) Union with displacement; *rotatory*, or transverse, with over-lapping of the fragments; and *or* longitudinal displacements. (b.) Union of two adjoining *bones*, as the radius and ulna, the tibia and fibula, or two *ribs*.

CAUSES.—1. The *external* causes of deformed union after Fracture may *circumstances* which occasion *displacement* of the fragments. *Unsuitable* retentive appliances, or their unsuitable application, *may* have this effect; so also, rough handling of the part, during the *of repair*. 2. *Internal* causes comprise *muscular action* displacing *fragments*, and *diseased* conditions of the callus; as exuberant callus, *growing* from inflammation affecting it during, or after, its formation.

EFFECTS of deformed union of Fracture are *mechanical*. If occur-

ring in the neighbourhood of a *joint*, its action will be in the *shaft* of a long bone, as the femur, ineffectual power is and in various ways, according to the direction of displacement, shortening of the limb occasions lameness. If two bones are conjoined, serious loss of function may be the result; as loss of pronation and supination of the forearm by union of the radius and ulna, and union may be unimportant; as in the case of the tibia and fibula.

TREATMENT.—(1.) *Recent union*, with displacement, propriety of endeavouring to rectify the deformity *gradually*, by extension or bending, and compression, may be applied by manipulation, from time to time, and the interim application of a retentive apparatus, or by means of some contrivance to maintain the displacement. Either should be worn as long as necessary, from three to five weeks. Successful results have been obtained in numerous fractures after union of some duration; as 25 years, and, possibly, after four or five months. In the event of a large callus, although still of recent formation, *refracture* is necessary; but this must be done cautiously. It may be accomplished in either manner—by manipulation, or by the application of a saw; either way, the object being to break the callus, under the influence of chloroform, and to reset the bone in its natural axis and position. An extreme period of union when this procedure can be safely determined principally by the *degree* of consolidation which has taken place. *Experience* has sanctioned different periods. Thus, the twenty-fourth week is the extreme limit advised by Osterlen. A little longer was conceded by Bosch, perle, and a half months. Mr. Skey, however, in one case refractured a boy, *et*at. fifteen, 13 months after the original fracture.

(2.) *Complete osseous union* can only be overcome by division. The callus having been laid bare, it may be *divided* of *section*—by a small saw or bone-forceps; or *excision* of the callus may be necessary, particularly if it be exuberant. The ends of the bone to be readjusted aright, and the case treated as compound.

For the inter-union of two *contiguous* bones, accompanied by loss of functional utility, as pronation and supination of the forearm, division of the callus is more imperatively necessary, if re-union is to be accomplished. But with union of the tibia and fibula, indeed any, operative proceeding is generally unnecessary. In all regards the junction of two ribs, is obviously impracticable.

Ununited Fracture, and False-joint.—Four varieties of Ununited Fracture are recognized; two of which may be referred to *non-union*, and two of *false-joint*; in either case, the union is *incomplete* to *complete*. They thus form a continued series of conditions, from imperfect union to perfect articulation. The fractured ends of a bone may be united by an ensheathing callus; which, however, fails to undergo ossification. This is known by partial mobility of the part when handled, and is proportionately useless. (b.) *Total non-union* may occur with no kind of connecting medium between the fractured ends, also apparently diminished in size. They are freely movable, and the limb is altogether useless and wasted. (c.) Most com-

state, the medullary canal is obliterated, the ends are rounded and covered by absorption, and covered in by the formation of a tissue binding periosteum; they are connected together by a strong ligamentous band, or by several narrow bands, firmly attached to the bones. New material is very pliable, and the *incomplete joint* thus considered is movable according to the length and laxity of such ligamentous connection. (d.) Lastly, and rarely, a dense *capsular ligament* is formed, and contain a fluid like synovia; the ends of bone have a smooth and polished, possibly eburnated, or covered with points of thin plates—of cartilage, and a synovial membrane similar to that of a natural articulation. Thus, then, a *complete false-joint* is effected. The limb is proportionately *useful*.

CAUSES OF UNUNITED FRACTURE.—1. The *external* causes of non-union after Fracture may be any circumstances which occasion motion of the fragments, beyond that degree which is compatible with the formation of a firm and its ossific consolidation. Unsuitable *retentive appliances* may have this effect, or their unsuitable application; so also, handling the limb daily or even more than occasionally, during the process of repair.

The practice sometimes witnessed, of frequently readjusting the fracture is as obnoxious as that which formerly prevailed, of close imprisonment and unalterably fixed position. 2. *Internal* causes comprise—*any action* separating the fragments and thereby preventing union, as in fracture of the patella, and in that of the olecranon; or the interposition of any *foreign body*, whereby union may be intercepted. A piece of muscle, tendon, or a clot of blood intervening, is thus obstructive; a piece of dead bone, in another case, retarded the process of repair for months; when the sequestrum being removed, union ensued in four weeks. (Schmucker.) Other local internal causes—not mechanically as impediments to union—pertain to the function of the bone at the seat of fracture. They are, chiefly, a *deficient supply* of blood to one of the fragments, as to the head of the femur, or of the humerus, in intra-capsular fracture of either of these bones; or both ends may be ill-nourished, as after the *main artery* of a limb has been injured; any obstruction to the circulation, producing *local anaemia*, or, very tight, or prolonged bandaging, or by an immovable apparatus; or especially refrigerant applications; or, on the other hand, inflammation, an abscess, or ulcer; *paralysis*, or any occasion of pressure on the nerves distributed to the seat of fracture; and lastly, *disease* of the bone itself.

The influence of *blood-diseases* in preventing or retarding the formation of callus, has already been noticed among the complications of fracture. The diseases alluded to are, chiefly, rickets, mollities ossium, cancer, scrofula, scurvy, fever, erysipelas, and the conditions of debility consequent on starvation and pregnancy. The same adverse effect is attributed also to habitual intemperance, copious hæmorrhage, profuse discharges; and, in short, whatever induces general enervation of the vascular and nervous systems with failure of nutrition. Age must be taken into account in considering the delay of fracture-union; but, while youth is certainly favourable to the speedy and firm union of a broken bone, the circumstances of ununited fracture do not commonly occur in old age.

EFFECTS of ununited fracture are entirely local and mechanical,

propriety by ext manipulation retentive the dis say, from numero and, pe ing cal sary; manne either chloro extrem determin taken Thus, to Oste and a l of a bo (2.) tion. of sect. be nec to be r For loss of divisio be acc indeed regard U

and therefore doubtful, in all cases. Experi the last six, or even eight months have Nature eventually improbable. In the process of natural cure may super the medium, and its ossific consolidation. For Ununited Fracture may remain in a process of union being arrested, in either of the the Fracture may become more movable by the completely (c), or completely (d), as a diarth Treatment.—Earliest occasion for inter course and tendency of Ununited Frac six, or even eight months, is the Surgeon will not take place.

Indications of Treatment.—Taking the st already mentioned, the indications of probably to non-union, in each of the two state (a.) With incomplete union, the general in to encourage, or excite, the process of ossifi to as to complete the reparation. The f in the continued treatment of the case a the reapplication of retentive apparatus, obs the reconstruction or adjustment, which all directed the circulation of blood, or the su when insuring rest to the part, and the o potential for reparative nutrition, ossification For special application previously in use, whi vitality of the part, must be discont consequences, suggest indications of local tre is to supply, if possible, any defectiv of the blood-diseases, which are severall prejudicial influence on the ossificatio been administered, or line

only performed. The one by *puncturing* the callus in two or three places, with the view of starting as many centres of ossification; for each purpose Brainard's perforator, or the Archimedean drill, being more handy, may be used. The instrument is introduced through the skin and adjacent integuments, and, having pierced the callus at one point, is supplied at another point, and so on, without withdrawing it from the skin. The other operation is accomplished by *dividing*, or at least *loosening*, the callus, subcutaneously, with a tenotomy bistoury, or a long narrow-bladed knife. In either proceeding, care must be taken, if possible, to avoid wounding any nerve or vessel of magnitude, adjacent to the callus, and to which it may be attached; and to at once close up the puncture, or the aperture, lest the fracture become permanently compound. Rigorous antiseptic precautions should be taken.

(b.) *Complete non-union* suggests the same treatment—local and general; and also the removal of any other local cause. Thus, an intervening piece of dead bone, or other mechanical impediment to union, may be removed. These remedial measures not succeeding, it will be advisable to remove the nearly lifeless and altogether ununited ends of bone. *Excision* is preferable to *scraping* or *rasping*, which, leaving the ends in a somewhat contused state, is less favourable to healing. Both modes of operation convert the fracture into compound.

Metallic ligatures have proved successful. Antiseptic precautions have tended to give greater confidence in this operation for the treatment of ununited fracture.

(c.) *False-joint—incomplete*.—A connecting medium, in the shape of a band or bands of *ligamentous tissue*, already exists, which may be induced to become the *matrix* of ossification. Hence, the *introduction of a foreign body* here and there, around the false-joint, may have this result. The operation, originally proposed by Dieffenbach, can be readily accomplished, by cutting carefully down to the seat of fracture, and drilling holes in the fragments with Brainard's perforator or the Archimedean drill, taking care that the point does not slip to either side of the bone, into perhaps a large artery or nerve; then introducing ivory pegs, four, five, six, or more, and driving them home with a mallet. The fracture, thus made compound, is reconverted into simple, by at once closing the incision with sutures. The wound should be dressed antiseptically. The pegs may lie buried, without giving any trouble, or are probably absorbed.

(d.) *Complete false-joint*—the most irrecoverable structural condition—suggests the same operation as for the incomplete condition; the introduction of ivory pegs, as foreign bodies, to induce ossification in the capsular ligament already existing as a matrix. Under these circumstances, however, it may be better "to let well alone."

Disunited Fracture is a parallel condition to Ununited Fracture. Union having taken place, and with firm osseous consolidation, a Fracture may again become disunited, loose and movable. The causes of disruption may be *local*; as mechanical violence, occasioning immediate destruction of the callus, or inflammation affecting it, and operating more slowly; or possibly some *constitutional* causative condition, as scurvy. The treatment accordingly must have reference to the nature of such causes.

CHAPTER XXVIII.

SPECIAL FRACTURES.

Fractures of the Cranium.—These Fractures are so intimately connected with Injuries of the Brain, that they are more conveniently considered with those lesions.—See HEAD-INJURIES.

Fractures of the Spine.—See SPINE.

FRACTURES OF THE FACIAL BONES.

(1.) **Fracture of the Nasal Bones.**—Displacement of the bone may be slight; or the bridge of the nose flattened or sunk; with more or less contusion of the integuments, extending even to the cheeks. The *lachrymal bone*, sometimes, participates in the injury, with rupture of the *lachrymal sac*, or of the nasal duct. The *cribriform plate* of the ethmoid bone has, it is said, been found driven up into the brain, thus occasioning serious or fatal injury to that organ.

SIGNS.—Hæmorrhage from the nose is often profuse and persistent. The appearance of the nose before the supervention of swelling is characteristic, if there be much displacement; and then, the loose movement of the fragments, and their *crepitation* in the spongy swelling, lightly handled with the fingers—feeling sometimes like a bag of bones—will at once suffice to detect the nature of the injury. A discharge of tears over the face, with emphysema of the eyelids and forehead, denote an extension of the fracture laterally to the *lachrymal bone*. Some symptoms of concussion of the brain may accompany the fracture, or those of compression, owing probably to an extension of the fracture to the ethmoid plate.

TREATMENT.—Without displacement of the bones, cold lotions and other applications, to subdue the inflammatory swelling, will be the only interference requisite. With displacement, the bones must be adjusted by a little manipulation externally, and within the nostrils by means of a director or other such instrument. Compresses should then be applied to retain the bones in position. *Persistent hæmorrhage* can be arrested only by plugging the nares, posteriorly and anteriorly, irrespective of the immediate consideration for the fracture. The fracture may be adjusted in the course of a few days. *Exfoliation* of the bones, and disintegration, must be treated according to circumstances. Union, with malposition, whether by lateral displacement or depression, as a “broken nose,” is unsightly. But this deformity can sometimes be overcome by Mr. Adams’s procedure—the forcible straightening of the displaced nasal bone, septum, or cartilage with a strong pair of forceps. The parts should be retained in position, by the patient wearing a steel screw-compress applied so as to support the *septum*; one blade being placed in each nostril, and the screw tightened just enough to hold the blades in contact with the septum, but without pressure upon it. This apparatus is removed after two or three days, and replaced by ivory plugs, to maintain the position.

dilation of the nostrils and support the septum. The plugs can easily be used by the patient.

1) Fracture of the Septum Narium—occurring in connection with a fracture of the nasal bones—may also happen, separately. The fracture generally takes place in the perpendicular plate of the ethmoid, extending to the vomer, and is produced by a blow or fall on the nose, sufficient to break the nasal bones. Displacement of the *cartilaginous* part of the septum is, however, the more frequent form of lesion; the cartilage being dislodged to one side, usually at its articulation with the osseous septum.

Examination within the nostril will at once disclose the nature of the fracture; the plate of bone, or the cartilage, can be seen and felt projecting to one side; and in the latter case, the whitish aspect of the cartilage is plainly shown through the thin, tense mucous membrane.

The fracture or displacement may be more or less readily reduced by manipulation within the nostril; but to maintain the parts in position, by the application of compresses, will tax the Surgeon's ingenuity.

2) Fracture of the Malar Bone.—Comminuted in most cases, the displacement of the fragments is inconsiderable, although spiculae may be driven into the temporal muscle. The *mobility* and *crepitation* of the fragments are scarcely rendered imperceptible by the swelling, which, however, is often most conspicuous. Fracture of other facial bones usually presents similar features.

TREATMENT.—Cold lotions may be applied in the first instance. Adhesion of the fragments will hardly be necessary, or may be accomplished by manipulation, partly, within the mouth; they are then retained in position by compresses suitably placed. The pain insures rest, any attempt to move the fragments or speak being intolerable. Fragments driven into the temporal muscle should be removed.

3) Fracture of the Zygoma is liable to occur with, or without, fracture of the malar bone. Some displacement inwards or outwards—elevation or projection—may be felt, but can scarcely be seen, as swelling supervenes; rendering also any mobility or crepitation, perhaps, imperceptible. A certain stiffness is sometimes experienced in opening the mouth, owing to impaction of the fragments in the tendon of the temporal muscle. In one case, I found the *articulation* of the zygomatic process of the temporal bone with the malar severed, unaccompanied by any fracture.

The broken or disarticulated ends of bone must be kept in apposition by the *artem*.

4) Fracture of the Upper Jaw.—The *nasal process* of the superior maxilla is liable to fracture with the nasal bones; and this must occur if the fracture extends outwards to the lachrymal bone, across the nasal process of the superior maxillary bone. The nostril is more or less closed by the displacement of the fragments inwards. The *alveolar process* also, a thicker portion of this bone, is occasionally broken, thus displacing the teeth. The *malar eminence*, externally, may participate in the fracture of the malar bone with which it articulates; and the *antrum* of the maxilla is, sometimes, crushed.

Violence only can occasion these severe injuries. Gunshot or the handle of a crane revolving and striking the face, thus pro-

duces fracture; involving, possibly, all the bones of the face in one common smash, or disjunction, with pulpification of the integuments. The face "feels like beans in a bag."

TREATMENT.—The contusion, which accompanies fracture of any portion of the upper jaw, always requires the application of cold lotions or the usual means to subdue inflammatory swelling. Adjustment of the fragments must be accomplished by proper manipulation within the mouth, and retained by any suitable contrivance. Union will be found to take place very readily.

(6.) **Fracture of the Lower Jaw.**—This bone may be broken in any part; the *body*, and particularly *between* the symphysis and insertion of the masseter muscle; rarely at the *symphysis*, in the *rami*, or the *processes*. Commonly, fracture is limited to one side of the bone. Its direction may be transverse, or oblique; and in the latter form of fracture, the pointed end of the anterior portion is apt to pierce the mucous membrane of the mouth, or to be tilted upwards by the depressing action of the genio-hyoid muscles; thus, in either way, rendering the fracture *compound*.

The **SIGNS** are some *unevenness* along the base of the jaw, the irregularity of the teeth, with *mobility* and *crepitus* when the parts are handled. The patient even experiences a harsh grating sound, conveyed through the temporal bone, as well as pain, on moving the jaw. The anterior portion is drawn downwards by the genio-hyoid muscles, and particularly if the fracture be in front of, and therefore unresisted by, the masseter muscle. Fracture on either side of the symphysis allows the middle, intervening portion of bone to be drawn more downwards. In any case there is also a dribbling of the saliva; which, at first, has a bloody tinge, from laceration of the gums, especially if the fracture be compound. Fracture of the *processes* is less easily recognized. The condyloid process, when detached, will be drawn forwards by the external pterygoid muscle.

Direct violence is always the cause of fracture in the lower, as well as in the upper, jaw; and such force must be considerable, as the bone is very thick, and readily moves from side to side.

TREATMENT.—The fragments can be easily adjusted, but less easily retained. A pasteboard or gutta-percha splint may be moulded to the base of the jaw; the upper jaw being used as a splint above. A four-tailed bandage, with a hole in the centre to receive the chin, is then applied; two ends tied over the top of the head, and two behind the neck, thereby fastening the jaw, both ways, in position (Fig. 11). Fluid nourishment only is allowed, which can be sucked in between the teeth. The patient should be fed through a suction tube, during the process of reparation. *Union*, and generally osseous, takes place usually in a month or five weeks.

Wire ligature has been employed in fractures of the jaw. The annexed figure represents one mode of applying the ligature (Fig. 12). The silver wire is passed through the opening at A. Then, the tubular needle (not shown) is passed through another aperture at B, into the open end of which instrument the return end of the wire being introduced, is withdrawn with the needle. The end of the wire at A is to be inserted into the slit of the key in figure, and twisted in three or four coils; and then the end of wire at B must be twisted in like manner until the fracture is firmly fixed. The wire will require to be tightened as it loosens, every three or four days.

Or the wire may be secured around adjoining teeth, in other cases, in an even line.

Fracture of the Hyoid Bone.—This injury occurs very rarely. The body of the bone may be broken, as in hanging; but more commonly, one of the great cornua gives way. In one instance I have seen a fracture at the junction of the great cornu with the body of the bone, on the left side.

The *mobility*, and perhaps *crepitus*, with some displacement of the fragments, are sufficiently characteristic. Besides which signs, there may be a sensation of something having snapped at the time of the injury, with hemorrhage from the throat and acute pain at the root of the tongue and in moving the organ; also perhaps difficulty in opening the mouth, or in swallowing, and loss of voice. These functional symptoms are usually associated with some amount of swelling and bruising, or more distinctive marks of violence, over the seat of injury.

Direct violence would seem to be the only occasion of hyoid fracture, as by the grip of an assassin, or by a blow or fall on the front of the neck;

FIG. 11.



FIG. 12.



but it is said to have been produced also by muscular action. Hanging, another instance of force compressing the hyoid bone, does not, I believe, generally produce fracture.

TREATMENT.—Adjustment of the fragment is easily accomplished by passing the finger of one hand into the pharynx, while coaptation is effected externally. Retention in position is far more difficult, owing to the mobility of the part, and the recurrence of deglutition. It has been proposed to embrace the neck in a firm pasteboard collar, as a splint; and thus fix the bone externally. But the liability of displacement in other directions, by muscular action, still remains a difficulty to be overcome.

Fracture of the Ribs.—One or more ribs, even several, may be fractured. The first, and perhaps the second rib, are seldom fractured, they being protected by the clavicle; and the last two false ribs also escape, as being floating, or freely movable. The *mid-ribs*, most exposed and fixed, are, usually, the seat of fracture. Any part of a rib is liable to be broken, by direct violence; but the convexity, or near the angle, yields mostly under the force of compression. Thus the mid-ribs, somewhere

hurriedly; and some irregularity or frequently usually be detected, at least during pain, occasionally disturbing the respiration. Hence the breathing is soon abnormal. *Hæmoptysis*, or a spitting of blood, may be the result of a rupture of the accumulation of air in the pleura, and the injury implicates the pleura and the fractured end, or ends, of bone. In the the parietal arteries, the increased dyspnoea the base of the thorax, would probably, and if the intercostal nerve be implicated, ordinary symptoms—the cough, pain, &c.

CAUSES.—*Direct* violence, as the cause of fracture, is, probably, some wound of the other viscera occasionally. *Indirect* violence, by a wheel passing over it, produces displacement outwards, and contusion or rupture of the lung. The seat of injury will, probably, be limited; though it also may be fracture of any rib, at any point, but generally that of the mid-ribs, at their costal ends. The ribs would seem to render persons of advanced age more liable to fracture arising from any compressing force. On the thorax yielding with cartilaginous resistance, the passage of a carriage-wheel over the chest may produce fracture. *Muscular action* has been known to produce fracture, as by contraction of the abdominal muscles.

Fracture unattended with any damage to the lungs, is generally cured favourably; *union* of the ribs taking place in 4 or 6 weeks.

TREATMENT.—Fracture of the ribs.

epileptory measures; thus to reduce the general circulation, and to relieve the embarrassment of the respiration occasioned by compression of the *ang.* in pneumothorax, or of the chest, in emphysema. *Venesection*, therefore, sometimes proves singularly beneficial, affording instant relief. Scarification of the emphysematous cellular textures may sometimes be resorted to, alone, or with venesection. But the air gradually disappears spontaneously in most cases. *Paracentesis*, or tapping the chest, has been performed for the relief of severe pneumothorax.

INFLAMMATION of the pleura or lung, supervening, must be met by the treatment appropriate for pleurisy and pneumonia.

COMPOUND fracture of the ribs, resulting from gunshot wound, is similar in all respects, otherwise than relates to the treatment of GUNSHOT WOUNDS.

Fracture of the Costal Cartilages may occur in any part of their extent from the ribs to the sternum, or at their articulations with either of these bones—a dislocation, more strictly speaking. TREATMENT requires no special notice. *Union* ensues through the medium of bone, forming an intermediate callus, an ensheathing callus also being supplied by the perichondrium.

Fracture of the Sternum.—Commonly transverse, very rarely longitudinal, and usually single; but this bone may be broken into three or more pieces. Fracture of the sternum is usually accompanied with fracture of the ribs, in their convexity; the same compressing force producing both injuries simultaneously. The *ensiform cartilage* may be driven backwards, and remain permanently depressed, even when in a cartilaginous state, and subject to the resiliency of its own elasticity.

COMPOUND fracture occurs sometimes, as by gunshot wound.

The SIGNS of this fracture are obvious: *crepitus*, and some *mobility*, felt on applying the hand over the sternum during coughing or the hurried respiratory movements; while some *inequality* of the bone, with any displacement, will also be perceptible. The respiration is principally abdominal. *Hæmoptysis* and emphysema, or severe palpitation, are present, when the injury involves the lung or heart. Or these organs may evince symptoms of having suffered compression, without penetration.

The CAUSES relate to various occasions of *direct violence*, as the wheel of a carriage passing over the chest, or gunshot wound; but the elastic and yielding nature of the ribs and their cartilages, and the spongy texture of the sternum, resist fracture of this bone. *Muscular action* also is said to have caused fracture; as violent contraction of the abdominal muscles during parturition, efforts at lifting heavy weights, or a fall on the back across a beam.

TREATMENT.—Position is of some importance, to relax the abdominal muscles more especially, and thus prevent displacement of the lower portion of bone forwards, which would result in angular deformity. If the patient be recumbent, the pelvis should be slightly raised; or sitting up, the shoulders should incline forwards. A *broad bandage*, encasing and fixing the chest, is applied, as for fractured ribs. It should be secured when the patient is making a full expiration.

Fracture of the Clavicle.—The clavicle may be broken in any part of its extent; commonly, in one of its two curves, and particularly, in its outer or scapular concavity. Rarely, fracture takes place external to the

coraco-clavicular ligament—in that part of the bone between it and acromion. On the *sternal* side of this ligament, fracture is oblique, from behind forwards and inwards; but it may be comminuted from direct violence. The *outer* or scapular portion is alone displaced, the inner portion being retained in position by the costo-clavicular ligament, and the opposed action of the sterno-mastoid and great pectoral muscles. The displaced portion is drawn downwards, forwards and inwards; under, perhaps, the inner portion, thus being overlapped to an extent varying from a quarter of an inch to an inch. This displacement is partly due to the weight of the arm, having lost its support from the sternum; but principally it results from the action of the deltoid and great pectoral muscles, the latter muscle drawing this portion of the bone forwards and inwards. Double fracture has been met with occasionally, both clavicles being broken, perhaps more often in children.

COMPOUND fracture has been known to occur, by direct violence, as the result of a very oblique fracture protruding through the skin.

The SIGNS of fractured clavicle are characteristic. When, as in the case of a fracture on the *sternal* side of the coraco-clavicular ligament, a *depression* corresponding to the displacement, is readily detected on passing the hand along the bone, *crepitation* also, and *mobility* of the outer portion on raising and rotating the shoulder, the elbow being kept to the side, is caused by this manipulation; and the patient is unable to raise his hand to his head, the support of the clavicle, necessary for this circular motion of the arm, having given way. The patient, with the other hand, holds the arm up to his chest, to relieve the powerlessness of the injured side, and inclines his head to the injured side, to relax the muscles from the clavicle to the head. This peculiar attitude of the patient is accompanied with a marked falling of the shoulder inwards towards the sternum, approximating the interval between these points; thus declaring the nature of the injury almost at a glance. Some crepitation also may be noticed on the shoulder, or over the seat of fracture, indicating the part struck, in thus breaking the bone.

On the *scapular* or outer side of the coraco-clavicular ligament, fracture is less obvious. Slight displacement of the fragment downward and *drooping* of the shoulder, may be observable; but this irregularity appears on pressing the arm upwards; and *crepitus*, with some motion of the fragment, are felt on raising and depressing the humerus, the arm being placed over the shoulder at the seat of fracture. The motion of the arm are scarcely impaired, as a sufficient support in the larger part of the clavicle remains.

CAUSES.—*Indirect* violence, the more common cause, produces fracture in the usual situation—the outer curvature, and obliquely across the clavicle. Thus, falls on the hand, elbow, and shoulder are special common causes of fracture in the curve of the clavicle. *Direct* violence produces fracture in the part struck, and probably of a comminuted character. *Muscular action*, as in using a whip, has been known to break the clavicle; the fracture occurring near the middle of the bone without displacement or only slightly forwards, and usually on the outer side.

TREATMENT.—On the *sternal* side of the coraco-clavicular ligament, displacement of the outer fragment,—inwards, forwards, and down-

be overcome by giving the humerus an opposite direction,—out-backwards, and upwards. The first direction is accomplished by in the axilla, and the latter two, by inclining the arm inwards the chest and *raising* the elbow. To keep the pad and arm in this position, many contrivances have been used. Before applying any such device bandaging or apparatus, it is well to provide against the superabundance of swelling in the arm and hand, by padding the palm with wadding or other soft material, and bandaging from the fingers to near the axilla. Then a good-sized pad, enclosed in a handkerchief, should be placed well up in the axilla, and the arm close to the chest as to draw outwards the scapular portion of the clavicle to an apposition with the sternal portion; the pad being secured in its position by tying the handkerchief at the opposite side of the neck. Inclining the arm inwards across the chest, until the hand points upwards to the opposite shoulder, a few turns of a roller round the chest enclosing the arm above the elbow, will secure this position. The forearm should then be secured in another handkerchief, from the hand to the elbow; care being taken that the elbow is well supported, upwards. Any particular shifting or loosening of these simple retentive appliances, subsequently, must be corrected; but the fracture should not be readjusted unnecessarily. A fracture, and of an ossific character, will have taken place, generally, in three weeks. But there is nearly always some amount of deformity shortening of the bone as the result of this, or I believe any other, method of treatment. Fortunately, however, such defects are of little consequence, eventually, in the use of the arm.

Objection has been urged, not without some reason, to the employment of an *axillary pad*, which is liable to induce paralysis of the arm, by pressure on the brachial plexus of nerves.

Various methods of treatment, of American origin, obviate the necessity of recourse to the pad, while they aim at depression of the sternal fragment by making tense the clavicular attachment of the pectoralis major muscle. *Sayre's method* consists in *drawing* the arm backwards, and the hand well forward and inwards. This is accomplished by the application of two broad strips of adhesive plaster according to the following directions given in Hamilton's treatise:—Each strip is about three and a half inches wide, for an adult; one long enough to encircle, first the arm, then the body completely; the other of sufficient length to reach from the sound shoulder, over the point of the elbow of the broken limb, across the back obliquely to the point of starting. Maw's moleskin, or some material of equal strength, should be used. The *first* strip is looped round the arm just below the axillary margin, and pinned to the chest, with the loop sufficiently open to avoid strangulation. The strip is then drawn downward and backward until the clavicular portion of the pectoralis major is put sufficiently on the stretch to overcome the resistance of the mastoid muscle, and thus draw the sternal fragment of the clavicle into apposition with the acromial fragment. The strip of plaster is carried completely around the thorax, and pinned or stitched to itself on the back. The *second* strip is now applied; commencing on the front of the shoulder of the sound side, it is carried over the top of the shoulder, finally across the back, under the elbow, which must be drawn well forward and inward, thence across the front of the chest to the starting-

exuberant as to extend down to the
and clavicle together, and thus into
the shoulder.

In *children*, the clavicle may be
fractured; the signs of fracture, in children,
obscured in a few days by soft union
around the seat of fracture, which
once declare the nature of the injury.
able, by bandaging; and the fracture
the starched apparatus.

Fracture of the Scapula.—Fractures
occur in any part of the bone; but
rarely. This distinction has reference
exposed situation of the bone, in its
angle is more commonly fractured than
the *coracoid process*, and the *neck*, both
be starved, but very rarely.

(1.) The **INFERIOR ANGLE** is simply
being drawn in that direction by the
magnus, and by the teres major and latissimus.

The *Signs*, therefore, are this displacement
fragment apart from the body of the bone
the angle when the scapula is moved.

(2.) The **BODY** may be fractured
the former direction usually, and close to the
Little displacement can take place, the
muscles; but with completely transverse
drawn forward.

The *Signs* are some displacement,
more readily, as an *irregularity* of the
with perhaps crepitus and mobility
degree of pressure to end of the bone.

ing placed over the shoulder; and the deformity of the shoulder appears, but it returns when the arm is again allowed to drop. The patient feels as if the shoulder were dropping off, and experiences a sense of weight and powerlessness in attempting to raise the arm. Dislocation is rare; sometimes even a false-joint forms.

The CORACOID PROCESS is sometimes knocked off; it will be *drawn outwards* by the biceps and coraco-brachialis muscles, and inwards also by the pectoralis minor.

Signs are partly obscure; no particular alteration in the shape of the shoulder, though the apex of the coracoid process can be felt lower than the sound side; but *mobility* of the fragment, with possibly some swelling, are very perceptible on *fixing* the scapula and moving the arm backwards and forwards. Fibrous union is not uncommon.

The NECK of the scapula—beyond the root of the coracoid process is occasionally broken off, carrying with it the glenoid cavity, and the coracoid process, and, perhaps, the acromion, with the adjoining portion of the scapula, which together fall *downwards* and *inwards* to the weight of the extremity. Fracture of the anatomical neck alone is rare; the coracoid process—perhaps never occurs. The coraco-clavicular and coraco-acromial ligaments may be more or less ruptured, depending on the degree of displacement.

Signs are marked *flattening* and *dropping* of the shoulder, and a *tumour* under the *acromion*, and a *tumour* in the *axilla*; thus far the fragment is dislocated downwards into the axilla. But *mobility*, and of this apparent head of the humerus, can be readily discovered by placing the hand on the shoulder, with the forefinger resting on the coracoid process, and rotating the arm; the crepitus being transmitted to that process, which still remains uninjured in its connection with the glenoid cavity, and the process moving with the humerus, instead of being fixed on the scapula, supported by the other hand. Moreover, the deformity of the shoulder disappears, and returns, as the neck portion of the scapula is replaced and displaced, by pressing the arm upward, and allowing it again to drop.

The GLENOID CAVITY may be the seat of a starred or comminuted fracture.

The *diagnostic signs* of such fracture would be obscure.

Etiology.—*Direct violence* is the only cause of fracture, in any part of the scapula. Not unfrequently, the subjacent ribs are broken simultaneously, and severe contusion or laceration of the soft parts, with such dislocation, give rise to serious consequences.

More than one fracture of the scapula may have occurred; or fracture, not only of the upper end of the humerus.

Occasions of direct violence are various. A heavy fall on the shoulder may fracture the acromion, coracoid process, or neck of the scapula. A severe blow, as by the pole of a carriage, has fractured the coracoid process; and gunshot injury of the back may fracture the body of the scapula.

Treatment.—The direction of the *displacement* indicates the proper position of the limb, and the application of retentive bandaging.

Displacement forwards of the *inferior angle*, or a portion of the *body* of the scapula, will be corrected by *drawing the arm inwards*, and thence *drawn* forward; in order thus to meet the fractured portion, which

cannot easily be kept back, although a compress may be placed of it. The arm must then be secured in that position, by a few a roller round the chest, and the forearm rested in a sling.

Displacement downwards and forwards of the *acromion*, or do and inwards of the *coracoid process*, or with the *neck* of the scap severely be rectified by elevation of the arm with an inclination in order to replace the fractured portion upwards and backward wards and outwards. Having, therefore, secured the arm slightly of the chest, by a few turns of a roller, the forearm must be well in a sling, especially at the elbow. In fracture of the *neck*, an

FIG. 13.*



pad will be necessary to guard against the of displacement. Thus, the treatment of fr the scapula, and of the neck in particular, that for fracture of the clavicle.

The union of all fractures of the scapula s ways results in some amount of deformity, the tendency to displacement under the mo treatment.

Fractures of the Humerus.—Fractur Humerus is liable to occur in any portion of t in the Upper Articular End, the Shaft, or in t Articular End (Fig. 13).

Fracture of the Upper Articular E take place in either of three situations. (1. CAPSULAR fracture—within the capsule—o anatomical neck. The head remains in the cavity, while the shaft of the bone is drawn and forwards to the front and outer side of the process.

SIGNS.—A *projection*, corresponding in sit the end of the lower portion,—the *shaft*, ca on the *outside* of the *coracoid process*, and a *tening* lower down may be perceptible—th being spread inwards by the shaft. But im below the *acromion* there is no hollow, the h bone remaining in the glenoid cavity; and t tive difference in the outline of the should guishes fracture of the anatomical neck of the from *dislocation*; nor can the head of the bone be felt in t *Crepitus*, and *immobility* of the head of the bone, may also b extending and rotating the humerus; if the muscular developme deltoid and the swelling consequent on contusion, do not togeth cushion of such thickness as to obscure these signs. Slight sho the arm will be discovered by measuring, as compared with the c

* Fractures of Humerus. Diagram showing situations and lines of chiefly from specimens in the Museum of St. Bartholomew's Hospital.—mical neck (St. George's Mus., 1, 89). (1.) Great tuberosity—compli fracture of acromion—not indicated in diagram (Univ. Coll. Mus., 103 gical neck. 3. Upper third. 4. Middle third. 5. Lower third. 6. through condyles, into elbow-joint (Royal Free Hospital). 7. Interna 8. External condyle. (Author.)

ance between the acromion and olecranon processes. Considerable experienced on moving the arm in examination; and it hangs as by the side.

CTED fracture of the *anatomical* neck is attended with a *notable* or lesser degree, of the ordinary symptoms; the head of the having been driven downwards into the cancellated structure of the tubercles. This injury more nearly resembles dislocation of the head into the axilla. Generally, however, intra-capsular fracture is attended with fracture of either or of both tuberosities, and then crepitus, mobility of the fragments, may be elicited by firm rotation, with the hand grasping the shoulder. (R. W. Smith.)

EXTRA-CAPSULAR fracture—beyond the capsule—and of the *surgical* neck, which includes the portion of bone below the tuberosities and the insertions of the three muscles into the bicipital groove—the *pectoralis* major, *latissimus dorsi*, and *teres major* muscles. Fracture in this situation is, sometimes, very oblique. The shaft of the humerus, in this fracture, is drawn inwards and upwards by the action of these muscles; and the upper fragment outwards, by other three muscles into the great tuberosity, the *supra-spinatus*, *infra-spinatus*, and *coracobrachialis*, or, counteracted, however, by the *subscapularis* muscle inserted into the small tuberosity.

Deformity of the shoulder is presented, under cover of the *pectoralis* muscle, but *lower* down than in fracture of the anatomical neck. Deformity corresponding to the displacement of the two ends of the bone consists of a *double projection*, inwards of the lower end, and outwards of the upper end. *Mobility* of the lower end, and *crepitus* on motion, and rotation, with some inclination of the humerus inwards—*being* outwards—and shortening of the arm, are even more evident signs. Pain, severe during any manipulative examination, irritation of the axillary plexus by the shaft-fragment, and inability to use the arm, conclude the diagnosis.

Separation of the *Upper Epiphysis* from the shaft of the humerus may occur at the line of junction, just below the tuberosities or at the commencement of the surgical neck. The *signs* are the same as in fracture of the anatomical neck; but there is an especial abutment of the shaft-fragment into the coracoid process, the larger size of this portion of the bone, at the base of the tuberosities, producing a greater prominence inwards than in fracture of the surgical neck. The projection has also a somewhat *angular* form and *smooth summit*, like the head of the humerus—for it might be mistaken, as a dislocation forwards—sub-coracoid. Extension and rotation will yield mobility and crepitus, and on again moving the part to muscular action, the deformity returns. Separation of the epiphysis happens only in *childhood* or *youth*, and may be

intra-capsular fracture of the *surgical* neck—the shaft penetrating the joint—is chiefly characterized by the *absence*, or minor degree, of ordinary symptoms. But the fracture is too low down to be well distinguished from dislocation into the axilla.

FRACTURE OF THE GREAT TUBEROSITY is an occasional form of fracture of the upper end of the humerus. A double displacement here, is produced. The tuberosity is drawn outwards and upwards by the

action of the three attached rotator muscles—supra-spinatus, infra-spinatus, and teres minor—this portion of the bone being found under and on the acromion. The head of the humerus is rotated inwards by the scapularis muscle acting on the small tuberosity; it lies on the inner of the glenoid cavity, and under the coracoid process.

SIGNS.—Deformity of the shoulder, corresponding to these displacements, is always conspicuous. *Marked flattening and great breadth of the shoulder*, even to double its natural breadth, catch the eye at once. A *double projection* may be felt—an *outer*, the tuberosity, beneath the acromion; an *inner*, the head of the bone, beneath the coracoid process, both, however, lying nearly on the same plane *horizontally*, and with an *intervening sulcus* or hollow below the acromion. Thus distinguished from fracture of the *surgical neck* by the position of the fragments, the fracture of the great tuberosity somewhat *resembles dislocation* of the shoulder, in its sub-acromial depression; and, indeed, partial dislocation *forms* might be said to have taken place. But the presence of *two osseous projections* is distinctive of fracture. *Crepitus* on approximating the portions of bone, and *mobility* of the tuberosity, are also diagnostic.

CAUSES.—*Direct violence* is, mostly, the cause of fracture of the upper end of the humerus. Thus, a heavy fall on the shoulder may occasion fracture of the anatomical or surgical neck, or of the great tuberosity. *Age* seems to favour the occurrence of fracture in the two first-named parts; the anatomical neck being broken more frequently in youth, although possibly at any period of life; while the surgical neck is broken away at the epiphysis is an accident peculiar to a period from infancy about the twentieth year.

TREATMENT.—These three forms of fracture of the upper end of the humerus may be treated alike, and with successful results. The fragments having been adjusted by extension of the arm, a *pad* should be placed in the axilla, so as to prevent any redisplacement inward. A *shoulder-splint* of gutta-percha or pasteboard is moulded to the side of the chest and arm, both of which are then *secured to the chest* by a bandage. The forearm rested in a *sling*, *without raising the elbow*, its weight tends favourably to prevent the recurrence of displacement upward.

Union may not take place in fracture of the *anatomical neck*, or even of the *epiphysis* only, or perhaps even a false-joint forms, if the neck be detached completely within the capsule. But, with partial attachment of the capsule to the head of the bone, the vascular supply not being entirely cut off, a bony union may result. (R. W. Smith.) *Impacted fracture* is a fracture in which the bone unites by bone, with the formation of an exuberant osteophytic deposit around the head, from the lower fragment—the tuberosities. A *capsular fracture* readily unites by bone, and especially when the fragments are impacted. Separation of the *epiphysis* allows of osseous union, and unites freely.

COMPOUND FRACTURE OF THE UPPER END OF THE HUMERUS.—This is a comminuted, and with great contusion of the soft parts, this condition of injury occurs only from gunshot wound of the shoulder, involving the adjoining glenoid cavity, or the processes of the scapula, or the axillary vessels and plexus of nerves.

TREATMENT.—Excision may be performed, when the injury is restricted to the head of the humerus, with, perhaps, splintering of the glenoid

scapular processes; and the best results have followed this operation in such cases. Amputation must be resorted to in any additional injuries to the vessels and nerves.

Fracture of the Shaft of the Humerus.—(1.) BELOW THE INSERTION OF THE THREE MUSCLES INTO THE BICIPITAL GROOVE, AND ABOVE THE INSERTION OF THE DELTOID.—Fracture in this portion of the shaft differs only from that of the surgical neck, in the relative displacement of the two portions of bone. The *upper* portion is drawn inwards, by the three muscles inserted into the bicipital groove; the *lower* portion outwards and upwards, by the deltoid muscle, and in the latter direction especially if the fracture be oblique.

The Signs also, thence arising, differ accordingly. Thus, *deformity* of the arm is presented, corresponding to these displacements, and consisting of two projections—an upper and a lower—but the upper will be felt on the *inner* side, the lower on the *outer* side, of the arm. *Mobility* of the fragments is very perceptible, giving a hinge-like motion to the arm on the gentlest handling, and *crepitus* can be readily elicited by extension and rotation; inclination of the humerus *outwards*, with some shortening of the arm, are equally conspicuous; and although the pain of manipulation may be less, the powerlessness is not less complete, than in fracture of the surgical neck.

(2.) BELOW THE INSERTION OF THE DELTOID.—Fracture in this portion of the shaft differs only from that above the deltoid, in the relative displacement of the two portions of bone, which are here reversed. The *lower* portion is drawn inwards and upwards, by the flexor muscles; and the more so in proportion to the obliquity of the fracture from above diagonally across the bone. The *upper* fragment may be slightly everted.

Signs.—A *projection*, corresponding to the lower end, is most perceptible on the inner aspect of the arm; with an inward inclination of the humerus. The other signs and symptoms—*mobility*, *crepitus*, shortening, pain, and powerlessness—are similar to those of fracture above the insertion of the deltoid.

CAUSES.—Violence, directly or indirectly applied, is generally the cause of fracture in both these portions of the shaft. Powerful muscular action has, however, been known to occasion fracture, usually transverse, and without displacement.

TREATMENT.—The ends of bone having been adjusted by gentle extension, three or four splints should be applied, so as to nearly surround the arm, and then be retained in position by a bandage. Bandaging the hand and forearm will, as usual, be a proper precaution against œdema; and a *sling* is used to suspend the forearm, *not* to *elevate* the elbow, which, hanging down, tends to prevent the recurrence of displacement.

Union by bone is the common result, although both Malgaigne and Hamilton concur in the greater relative frequency of fibrous or of non-union than after fracture of the shaft of any other bone.

Fracture of the Lower Articular End of the Humerus.—(1.) TRANSVERSE FRACTURE OF THE LOWER END.—SUPRA-CONDYLOID FRACTURE.—In this fracture, considerable displacement of the lower or articular fragment backwards, carrying with it the forearm, is produced by the action of the triceps muscle; and a corresponding displacement forwards of the lower end of the shaft of the humerus.

merus, involving the *musculo-spinal* nerve as it turns in the groove, inwards and outwards on the posterior aspect of the shaft. Or, if not at the time of the injury, some paralytic symptoms may result from compression of the nerve by ensheathing callus. The position the arm assumes is that of pronation, with the hand pendent, or a characteristic *wrist-drop*, with perhaps a crippled *club-hand*.

In the treatment of wrist-drop, and of the paralytic club-hand, a splint should be applied, to counteract the tendency to permanent flexion and deformity; and the restoration of nerve power may be aided by the *galvanic current*. But its influence will have little effect if the nerve-lesion is nearly complete. When an *ant callus* can be felt anywhere in the course of the *musculo-spinal* nerve, a portion of the bony clasp should be removed so as to disengage the nerve; and operation of *excision* has been followed by the cure of the paralytic affection, in a few instances.

Fractures of the Forearm.—The Radius and Ulna are each, singly or conjointly, liable to fracture, in various situations here delineated (Fig. 14).

Fractures of the Ulna.—(1.) THE *OLECRANON*.—An oblique fracture not unfrequently occurs, with displacement upwards by the action of the triceps muscle, and which varies in extent according to the extent or partial rupture of the tendinous expansion of the muscle.

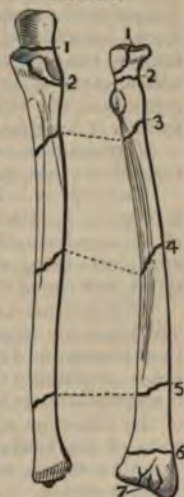
SIGNS.—An interval between the fragments is presented; and the forearm being partly flexed, the unopposed action of the flexor muscles, that interval is increased. *Mobility* of the olecranon, and *crepitation*, easily produced when the arm is extended, will further indicate the nature of the injury. Considerable fluid swelling over the seat of injury may render these signs obscure.

CAUSES.—*Direct violence*, as a smart blow with a hammer or a fall on the elbow, is the usual occasion of fracture; and of the contusion which then accompanies it. But a violent action of the triceps muscle will, sometimes, snap off the olecranon. *Dislocation* by *ligament* ensues in most cases. Bony union may form when the olecranon is in perfect apposition.

TREATMENT.—The displacement is reduced by an extended position of the forearm; and maintained by means of a splint applied in front of the elbow-joint, passing some distance along the arm and forearm.

Bony union has been obtained in a few cases, by wiring the fragments

FIG. 14.*



Fractures of Radius and Ulna. Diagram showing situations and lines of fracture; chiefly from specimens in the Museum of St. Bartholomew's Hospital.—*Radius*.—1. Through head, longitudinal (St. George's Mus., 1, 111). 2. Through middle, transverse (Mütter). 3. Upper third, both bones. 4. Middle third, both bones. 5. Lower third, both bones. 6. Carpal end, or Colles' fracture. 7. Ditto, comminuted into wrist-joint (St. George's Mus., 103).—*Ulna*.—1. Through olecranon, transverse (St. George's Mus., 1, 111). 2. Through coronoid process, transverse (St. George's Mus., 1, 111). 3, 4, 5, as in radius. (Author.)

process, and *crepitation*, in the bend of the elbow.

CAUSES.—*External violence* is probably the cause of *Direct violence*, as crushing injuries of the elbow, the coronoid process, or any other part of the elbow; but *indirect force*, as a fall on the palm of the hand, may fracture the process in conjunction with dislocation of the elbow—*action*—that of the brachialis anticus—is common to both. Sometimes the occasion of fracture: but the opinion is doubtful.

Ligamentous union seems to be the mode of union that may occur; but, perhaps, only in fracture at the elbow.

TREATMENT.—Flexure of the forearm to a favourable position for union. This position may be maintained by an *angular splint*, and the forearm carried in a sling for a few days; care being taken to prevent ankylosis by frequent motion, and use of the sling alone for two or three weeks.

Compound and Comminuted Fracture

The bones are comminuted, often extensively, and the integuments are lacerated. The injured bones, crepitating under manipulation, or motion, are singularly loose and movable. One or two trifling fractures of the elbow, or near the condyles, communicate with the joint; which results from *direct violence*. Laceration of the soft parts accompanies the fracture in gunshot wound.

TREATMENT.—Preservation of the limb, excision of which operations may be performed primarily, and severally to be considered, as indications of treatment.

Compound fracture, alone, without comminution of the soft parts, will allow the opportunity, at least, of saving the limb.

Comminution to even a considerable extent, is

The usual **SIGNS** of Fracture are present. Deformity at the seat of fracture, corresponding to the displacement; *mobility*, *crepitus*, *shortening*, with some alteration in the direction of the axis of the bones, or forearm below the fracture; pain, and inability to use the hand, with some loss of pronation and supination, if the radius be broken.

CAUSES.—*Indirect* violence is, mostly, the occasion of fracture; as by a fall on the hand. Hence the radius yields more frequently than the ulna. *Direct* violence may sometimes be the cause; the middle or lower portion of the shaft being more liable to be broken than the upper portion, which is protected by a considerable thickness of muscle.

TREATMENT.—The fractured ends having been adjusted, a *pad* should be laid along the *interosseous space*, to prevent any inclination of the bones inwards; as union or ossific deposit across this space would render pronation and supination imperfect or impossible. For this reason also, the forearm should not first be bandaged *under* the splints. A *long splint*, extending from the bend of the elbow to the fingers, is placed on the *inner aspect* of the forearm and supporting the *hand*. A corresponding *splint*, on the *outer side*, need reach only to the *wrist*. Both the splints should be a little broader than the arm, so that, in bandaging, the bones may not be compressed; a roller is then applied from the fingers upward, and the forearm rested in a sling.

Another method has been devised, and practised with success, by Dr. X. C. Scott, of the Brooklyn City Hospital, U.S. The forearm is placed in the supine position, and retained, with sufficient extension from the wrist, by means of adhesive plaster, with elastic bands; counter-extension being made from above, with the arm at a right angle.

Compound Fracture of the Forearm.—Usually arising from *direct* violence, there may be far more extensive disorganization subcutaneously than appears from the comparatively uninjured integument. The question of amputation will be guided, mainly, by this consideration.

3. (1.) **Fracture of the Lower End of the Radius.**—Known as *Colles' fracture*, when situated about an *inch* and a *half* (Colles), or an *inch*, but usually less (R. W. Smith), above the articular surface; this fracture is generally transverse; sometimes comminuted; or impacted,—the upper fragment, or shaft of the radius, in its *posterior* wall of compact texture, penetrating the cancellated texture of the lower or articular fragment. Displacement of both fragments occurs. The *lower* or *articular fragment* is displaced backwards and upwards, and slightly outwards, with some degree of similar rotation on its horizontal axis, (instead of the carpal surface having its normal aspect); this fragment being drawn in these directions by the action of the two radial extensors of the wrist, the three extensors of the thumb, and by the supinator *longus* muscle; or similar displacement with impaction may arise from the direction of the force of fracture, when caused by a fall on the palm of the hand. The *upper fragment* is pronated by the pronator quadratus and *teres* muscles. According to Nélaton's observations, the styloid process of the ulna is often broken, and the triangular ligament torn, in connection with this fracture of the radius.

The **SIGNS** of Colles' fracture resemble those of fracture in general, but have certain characteristics in this situation. 1. A *prominence* to be seen and felt at the *back of the wrist*, just above the *joint*, corresponds to

the *lower* or articular fragment (Fig. 15); immediately above this depression corresponds to the somewhat depressed upper end of the radius, this *sulcus* having an *oblique* direction from above downwards towards the head of the ulna. The *palmar* aspect of the forearm above the wrist, presents the opposite appearances: a marked *hollow* or *sulcus* underneath the articular fragment; and immediately above, the *prominence* of the upper fragment-end, pronated by the

FIG. 15.



anterior muscles, and bulging of the flexor muscles, as far as the deep and *sulcus*, and above subsiding gradually into the level of the rest of the forearm. These appearances are, of course, more marked or perhaps restricted to the side of the forearm; and it is most conspicuous when the arm is viewed laterally. The hand is *prone*, and drawn downwards and, pronely, inwards; presenting a *concavity* on the *radial* side of the wrist, and a *convexity* on the *ulnar* side, the *styloid process* of the ulna projecting under the integument and towards the palm. 3. *Mobility* of the radius above the fracture, the lower fragment not moving with it, and *crepitus*, are both elicited by rotating the bone, with some extension; for this purpose, the operator, grasping the hand, to extend and rotate, should hold the seat of the fracture between his thumb and fingers; when the fragments have regained their relative position, the *natural form* of the part is *restored*; on extension, the *deformity* is immediately *reproduced*. 4. *Pain*, and *ping powerlessness* of the hand, with loss of pronation and supination, supply additional signs and symptoms, which further manifest the nature of the injury. Considerable swelling soon supervenes, concealing the characteristic deformity.

DIAGNOSIS.—(1.) Thus Colles' fracture of the lower articular end of the radius will be distinguished from *sprain* of the wrist, and from *dislocation* of the *hand* and *carpus backwards*; the diagnosis of these injuries is obviously of great practical importance in relation to their appropriate treatment.

(2.) *Comminution* of the lower or articular fragment will render these signs *more perceptible*; *mobility* and *crepitus*, in particular.

(3.) *Impaction* of the upper into the lower fragment—as also *dislocation*—would render the two latter signs *imperceptible*, more or less entirely according to the firmness of the lodgment. The *impaction* sometimes varied—according to Voillemier—by displacement of the fragment *forwards* (instead of backwards); the *anterior wall* of the bone above then passing into the cancellated texture below.

(4.) Separation of the radial *epiphysis* must be a very rare form of fracture. I know of only two instances in which it has been verified by dissection.

(5.) Fracture of the lower end of the *ulna*, with that of the radius, *constitutes* *dislocation* of the *wrist backwards*. *Mobility* of the carpal fragments in connection with any movements of the hand, and *crepitus*, are distinctive signs of this double fracture in the vicinity of the wrist-joint.

—*Indirect violence*, by a fall on the *palm* of the hand, is the cause of fracture, thereby breaking the radius transversely within its articular surface, perhaps also comminuting this fragment, allowing the upper fragment-end to be driven into, and impacted on the *back* of the hand may cause a similar fracture, but the lower fragment forwards instead of backwards. Colles' fracture is said, be occasioned by *direct violence*. I am not acquainted with such a case.

Treatment.—Reduction of the displacement often requires consideration and counter-extension to effect it satisfactorily, not to say

Many forms of splint or retentive apparatus have been employed. Splints are commonly used: a long, curved, or pistol-shaped splint, extending from the elbow to the fingers, whereby the hand can be held downwards to the *ulnar* side; and a short, straight splint, from the elbow only to the wrist. These splints may be applied along the palmar surface of the forearm and hand, and the other surface of the forearm; or in the *opposite* arrangement.

They are bandaged from below; the hand to the curved portion of the palmar splint, and the roller being continued upwards around to the elbow. The forearm is then rested in a sling.

A splint may be used with advantage, for correcting the displacement when Colles' fracture cannot otherwise be kept reduced. This consists of two pieces: an anterior, which is provided with a hollow on the outer side of the hand, and a posterior splint, which rests on the back of the wrist. The fracture having been reduced, and placed in the prone position, the splints applied are retained by buckling bands. Any displacement of the upper end of the radius is controlled by the anterior splint; while the hand dropping over the posterior splint, raises the lower or carpal fragment to a level with the radius.

Healing takes place in about a month, but rarely without some displacement and stiffness in moving the wrist and fingers also for a considerable period. Passive motion and friction should be used, in anticipation of this result. Some deformity remains, except in rarely perfect results.

A fracture of the lower *epiphysis* of the radius has occurred in youth; a comminuted fracture, and requiring the same treatment.

Fracture through the Head of the Radius, occurring alone, is never been met with. In conjunction with fracture of the head of the ulna, and dislocation of both bones backwards, this injury has occurred in two instances.

Fracture of the Neck of the Radius.—This injury, uncommon, any other fracture or dislocation, must be exceedingly rare. A crepitus will be more or less perceptible, with flexion of the wrist, and loss of pronation and supination.

Treatment should consist in a *flexed* position of the forearm upon the chest, the biceps, the application of a compress over the abutting point, and a *dorsal angular* splint; the whole being secured by a bandage, and rested in a sling.

Fracture of the Carpal, Metacarpal Bones, and Fingers.—Compound Fractures of these bones may occur; and with the

in each of its several parts, and readily recover

Fractures of the Pelvis.—(1.) **Fracture of the Pubic Bones.**—Commonly, the *rami* of the pubis are fractured; sometimes, the line of fracture passes across the *ilium*, in various directions; or it may fissure its floor, or fracturing its margin. Sometimes comminuted, or simply divided into its three parts; the head of the femur driven into the pelvic cavity; being detached, dislocation backwards takes place; or, perhaps any portion, of these bones may be broken, for example, a rim-like piece of the *crest* of the *ilium* or *ischium*. Both innominate bones are not uncommonly fractured somewhat symmetrically; as, corresponding portions of the pubis and ischium.

Separation of the *symphysis pubis*, or of either of the *acetabula*, rarely takes place. I have, however, met with the three articulations in the same person; but only

Little or no displacement is liable to occur, on motion; the bones being well held together, and the *ligaments* being strong. But the *pelvic viscera* are frequently injured; the *urethra* giving rise to extravasation of urine; lacerations occurring; or of the larger blood-vessels, with

The Signs of fracture of the innominate bones are: irregularity of the bone at the seat of injury; *swelling*, *tenderness*, *mobility* and *crepitus*, on moving each half of the bone forwards, will be readily perceptible; while the *rectum*, by the finger in the rectum or vagina, with external pressure, or by then flexing or extending the trunk, the ability to support the trunk are experienced by the patient to move or stand up. *Inability to empty* the bladder denotes some injury to this organ; and occurring

ES.—*Direct* violence is almost the only cause of fracture of the A heavy fall, or a crushing compression of the innominate bones, cart-wheel passing over the pelvis, or the force of a squeeze the buffers of two railway carriages; such, and similar accidents, ordinary occasions of these injuries; or they result from the formidable contusion of gunshot wounds. *Indirect* violence sometimes produces fracture of the pelvis; as of the acetabulum, when a person falls from a height and alights on his feet.

SE AND TERMINATIONS.—*Union* of the fracture takes place generally without difficulty, resulting only in some degree of lameness. This occurs more frequently in fracture of the acetabulum, with dislocation to the nature of the injury not having been detected, or the inability of maintaining reduction. Permanent lameness ensues. But *visceral injuries* are of more serious or fatal consequence. The chief danger in such cases depends on the situation of the injury; whether, laceration of the bladder opens into the peritoneal cavity, with extravasation of urine internally or externally. In the one case, death is inevitable; in the other, urinary infiltration behind or in front of the perineal fascia, will be followed by suppuration and sloughing, and may terminate in death.

TREATMENT.—Any *visceral* injury demands immediate attention. A rectal catheter should be introduced to discover the state of the bladder. If there is any evidence of injury to this organ or the urethra, the rectal catheter must be kept in the bladder, to prevent extravasation.

In the event of extravasation externally, early and free incisions of the scrotum may avert the full extent of the local mischief, and the patient may escape the typhoid disorder. But the treatment of such Extravasation is described in a subsequent chapter. The *fracture* itself requires very little surgical manipulation. The pelvis should be bound with a broad roller, or rib-bandage, and the patient laid *recumbent* on a flat bed or mattress, sufficiently firm to counteract any tendency to displacement. The thighs should be flexed upon the abdomen, and supported with pillows under the knees; this position preventing displacement by muscular action, and often proving also the most comfortable.

The fracture of the *acetabulum* must be secured by means of a *long splint*, or a splint of gutta-percha, moulded to the side of the pelvis and secured to fix the joint. Angular extension is recommended by Dr.

who then applies an angular splint, with the limb suspended by a bandage; or, he observes, if in any manœuvre reduction is effected, the limb should be retained, if possible, in the attitude which completed the reduction.

Fracture of the Sacrum.—Exceedingly rare, fracture of the sacrum may, however, occur in *conjunction* with that of the innominate bones. The fracture then takes place at any part of the sacrum, and in any position; but it may happen *independently*, and then generally below the iliac articulation, and transversely across the bone. In this case, the displacement is almost always the same; the coccygeal extremity is driven forwards, without probably interfering with the rectum or

Symptoms.—There is an *angular projection* backwards at the line of fracture, corresponding to the displacement forwards, mobility and some

crepitus; with *pain*, greatly aggravated in any attempt to bend or the body, and especially acute in any efforts at *defecation*.

CAUSES.—Fracture of the Sacrum arises from the same causes of the innominate bones; and from blows or falls on the sacrum in fracture transversely below the sacro-iliac articulation.

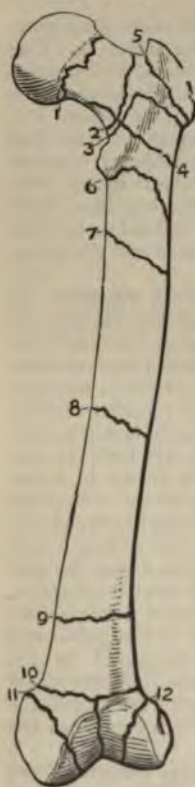
COURSE AND TERMINATION.—If fracture of the sacrum occur in conjunction with fracture of the innominate bones, the accompanying lesion of the pelvic viscera generally prove fatal. Fracture of the sacrum alone is usually followed by a recovery, although the inward displacement often be completely overcome.

TREATMENT.—The displacement may be corrected by passing a finger into the rectum and pushing back the coccygeal portion of the sacrum. A great difficulty will often be experienced in reaching it there. Various contrivances have been used for this purpose, such as the introduction of a wooden cylinder, or other form of compress, against the bowel. Any such body must be removed every two or three days, and an enema administered. The action of the bowels should be rather restrained by opiates, thus to prevent disturbance of the daily evacuation; while some accumulation of feces in the rectum may act as an efficient support instead of using any artificial form of rectal support. A roller drawn firmly round the pelvis, as a support of a *flat, resisting mattress*, insures the requisite for union. This takes place in a month, or a shorter period, according to the frequent disturbance of the part by the act of defecation.

Fracture of the Coccyx is an uncommon accident. The pain and inconvenience by occlusion of the rectum may be very persistent, after the fracture itself is repaired. The sitting posture will be made more tolerable or comfortable, by using a pad on each tuberosity of the ischium. A shoe-shaped air-cushion will also give great relief, as I have known in cases of *coccydynia*, a neuralgic affection of the coccyx.

Fractures of the Femur.—Like other long bones, fracture of the thigh-bone may occur, at the Upper Articular End, the Shaft, or the Lower Articular End (Fig.

FIG. 16.*



* Fractures of Femur. Diagram showing situations and lines of fracture chiefly from specimens in the Museum of St. Bartholomew's Hospital.—1. Capsular. 2. Extra-capsular. 3. Through great trochanter. 4. Inter-trochanteric. 5. Summit of great trochanter, or epiphysis (Middlesex Hosp. Mus., 111). 6. Below trochanters. 7. Upper third. 8. Middle third. 9. Lower third. 10. Between condyles, into knee-joint (St. Bartholomew's Mus., C. 13). 11. Internal condyle. 12. External condyle. (Author.)

fractures of the Upper Articular End comprise those of the within, or outside, the Capsule, and Trochanteric Fractures.

1) INTRA-CAPSULAR FRACTURE OF THE NECK OF THE FEMUR.—In an intra-capsular fracture of the neck of the femur is, generally, an oblique—from above downwards and outwards, including some portion of the head; occasionally, it is quite transverse. The periosteum is generally rent asunder *incompletely*, but sometimes *completely*. Displacement of the two fragments usually occurs; the lower fragment, the shaft of the bone, is drawn upwards and to the posterior side of the head of the bone, and rotated so that the head end is directed forwards. The upper or articular fragment is in position; the head of the femur in the acetabulum, and held by the round ligament.

A FRACTURED fracture is not very common, in my experience; the lower fragment being forced into the upper, the arch of the bone in the under part of the lower fragment lodging in the articular tissue of the femoral head, the upper arch overlying the surface of the head or even overlying its cartilaginous surface. It is attended with a subsidence of the head to the level of the greater trochanter. (R. W. Smith.)

2) INTRA-CAPSULAR FRACTURE OF THE NECK OF THE FEMUR.—In intra-capsular fracture of the neck of the femur, (1) the femur is shortened, and everted; with the leg slightly flexed, the toes turned outwards, and the heel drawn outwards, resting in the interval between the inner malleolus and the Achilles, or on the inner side of the leg above the ankle, of the foot (Fig. 17). (2) The hip is somewhat flattened, the prominence of the great trochanter being lessened, and drawn upwards to the level of the superior spine of the ilium. (3) Drawing the limb downwards to its proper length, and rotating it,

the crepitus and mobility of the lower fragment will be felt, when it is placed over the trochanter; and this prominence of bone is in a less regular and smaller segment of a circle than on the sound side. On leaving the limb to itself, shortening, and everted attitude, return. (4) Pain, in the whole region of the hip, especially near the insertion of the psoas muscle, is rendered severe by attempt at motion, particularly by inward rotation; and this

FIG. 17.*



* Intra-capsular fracture of neck of Femur. (Author.)

symptom, with nearly total *powerlessness* of the limb, conduces to diagnosis. The *patient*, in the recumbent position, can draw the limb up to some extent, with the foot resting on the bed, and he can extend the limb; but he cannot perform rotation inwards.

Shortening, in the first instance, varies from *half an inch* to as much as *two inches* or more, as the cervical periosteum is ruptured, and as the capsular ligament yields more completely to contraction of the muscles or by bearing on the limb, or if the fracture becomes dislodged. But shortening of the limb may be produced by slight flexion, as an effort of the patient thus to relax the muscles which act upon the hip-joint, in order to relieve the pain in the hip; it may, therefore, indicate simply a *sprain* of the joint: or, it may result from *hip-joint disease*, *former fracture* of the thigh or leg, *deformation*, or *arrest of development*. Any *obliquity of the pelvis* may affect the comparative length of the two limbs. To determine whether shortening be apparent or real, the patient should be laid upon his back with the pelvis even on either side; then the relative length of the limbs can be estimated by observing whether the soles of the feet are on the same plane; but *measurement* with an inextensible, graduated tape affords the only exact and conclusive evidence—observing to draw the tape between two fixed points, the anterior superior spinous process of the ilium, and the lower margin of the inner malleolus of the ankle. To find the actual length of the limb, as compared with the other, is impossible. Possibly, *no shortening* may take place at first, no displacement occurring, and this state may continue for a period of some hours, or days; on the other hand, considerable shortening may be induced by a *rough examination* of the limb. *Eversion* is produced partly by the action of the external rotator muscles inserted into the great trochanter, and partly or principally as the natural position in which the lower limb falls when left to itself. *Inversion* so rarely occurs, but very rarely; and is owing, probably, to the action of the adductor muscles, in conjunction with some partial rent of the capsular ligament favouring such muscular action. Neither eversion nor inversion of the foot may be present, according to Hamilton, in some cases, the toes pointing directly forwards.

IMPACTED fracture is denoted by an *absence* or *minor degree* of the signs, *except shortening*. The *patient* may even be able to bear weight on the limb, in bearing weight, or in walking perhaps a considerable time after the injury. (R. W. Smith.) Some degree of *shortening* of the lower limb, which *cannot be extended* to its original length; accompanied by the other signs of fracture—or dislocation—and *immediately consequent* on some occasion of *injury*, is diagnostic of fracture with *impaction* of the fragments,—an impacted fracture. *Eversion*, or occasionally *inversion*, with impacted fracture, may be produced, partly by the causes already mentioned, but specially, perhaps, by the direct violence of the impaction, giving a turn to the limb one way or the other.

The *DIAGNOSIS* from *contusion* of the hip is most important. In the conditions of hip-injury, the symptoms and signs are similar; but the relation of the great trochanter to the anterior superior spine of the ilium will chiefly distinguish fracture of the femoral neck, impacted, from contusion of the hip. The difficulty of distinction is, however, in

contusion be that of a joint which has long been affected with *rheumatic arthritis*, for here the trochanteric relation is the same; *history* of previous pain and lameness will indicate the rheumatic case, and the recovery of the former use of the limb, in a very short period, attests the absence of fracture. Contusion is followed by a real shortening of the limb and eversion of the foot, *ostial absorption* of the femoral neck; but this is a subsequent shortening, and occurs especially in patients of advanced

age.—*Indirect violence*, but of so *slight* a character, in many cases scarcely to exceed a stumble, will, generally, be found the only cause to which intra-capsular fracture of the neck of the femur is referred. A slight trip of the foot, slip, or mis-step in going down the usual occasions of this fracture. But *age* very much *pre-*disposes to the injury. It *seldom* happens in persons *under fifty*; and the predisposing condition consists of an alteration in the structure, and the direction of the neck of the femur, thence favouring the occurrence of fracture in this portion of the bone. Its cancellous texture having undergone fatty degeneration, or disintegration, the neck gradually yields to the weight of the trunk; the order of the neck, originally the longest, thus becomes shortened, and the whole neck drops to nearly a *right angle* with the shaft. This horizontal direction, in particular, renders the neck unable to sustain the shock of any force transmitted through it, and which throws the weight of the trunk suddenly on this part of the bone. It snaps instantly and easily—perhaps, almost invariably. The circumstances of age, and the slight indirect violence, with the production of intra-capsular fracture, should be considered in the signs already mentioned, in aid of the *diagnosis*.

By *ligament* ensues, as the only mode of reparation in most cases when the upper fragment is impacted. Or *no* union may take place, the portion of the neck and head, in the acetabulum, undergoes to some extent, while the trochanteric fragment becomes enlarged and expanded, apparently as the result of constant pressure on it; or a false ball-and-socket joint forms between the ends of the fragments. *Bony* union, at one time and for many years thought to take place, does assuredly result in some rare cases; but *only*, it is when the capsular ligament remains entire, or the fragment is impacted, whereby a due supply of blood can be speedily

restored to the limb is not restored under *three* or *four months*.

TREATMENT.—No bony union taking place, as a rule, in intra-capsular fracture of the neck of the femur, it will generally be useless to adjust the fragments and apply any retentive apparatus, with a view to such union; the more so, in proportion to the years of the patient. In persons, and those to whom any long confinement would be injurious, their general health is of more consequence than the fracture, and it is itself irreparable in advanced life.

The limb may be placed in an easy position, until pain and the serious consequences of the injury have subsided, when a splint to the hip should be applied, and the limb slung from the foot

by a long band passing round the neck; the patient thus being enabled to get about on crutches.

2. In younger subjects, the fracture may be adjusted, and a splint applied, with *weight-extension* from the foot, as for the treatment of fractures of the femur. 3. Admitting the possibility of bony union, the uncertainty of diagnosis between intra-capsular and extra-capsular fracture of the neck of the thigh-bone, it is deemed advisable by Surgeons of experience to treat *all* alike by retention, excepting the special circumstances of advanced age or debility.

IMPACTED fracture should be treated by means of the splint fixation, as the limb cannot be extended to its original length.

(2.) EXTRA-CAPSULAR FRACTURE OF THE NECK OF THE FEMUR. In this situation, extra-capsular fracture may occur at any part of the neck external to the capsule; but generally at the *base*, corresponding

Fig. 18.



nearly with the anterior and posterior trochanteric lines (Fig. 18). *Comminuted* fracture is most invariably produced; and, probably, the fracture involves penetration of the *upper fragment* into the greater trochanteric fragment, so as to split it into two or more pieces. The *direction* of the fracture is also remarkably uniform; the greater trochanter usually being divided from the centre of its summit, obliquely downwards and forwards towards its base, and the fracture terminating a little short of the greater trochanter or penetrating beneath its base. Two lines also usually traverse the great trochanter horizontally.

IMPACTED fracture is produced, when the upper fragment is driven into, and partly imbedded in, the trochanteric fragment, the compact portion of which embraces, and fixes, the neck of the femur, thus shortening and slid down nearly to a right angle. Probable causes of extra-capsular fracture, impaction takes place, accompanying a trochanteric fracture, as a secondary but immediate consequence; and when the fibrous investment of the trochanter also yields, the extra-capsular fracture is declared.

The SIGNS of extra-capsular are the same as those of intra-capsular fracture, but *more marked*. Thus, *shortening*, averaging one-fourth of an inch—in forty-two cases—may reach to two, three, and four inches. *Eversion* is very conspicuous, but inversion not uncommon compared with intra-capsular fracture. *Flattening of the hip* is marked, unless swelling, which is often considerable, has supervened. *Crepitus* and *mobility* are equally notable; and these three signs are even more pronounced with *comminuted* fracture. *Pain*, always present, and *total inability* to move the joint, will no less attract the attention of the Surgeon.

IMPACTED fracture renders all these signs obscure or impossible. *Shortening*, which varies from half an inch to an inch, is not so marked, and the limb may be extended to its original length.

CAUSES.—*Direct* violence, as by a fall on the hip, is the usual cause; occasionally, *indirect* force, as by a fall upon the

Age has less *predisposing* influence than with relation to intra-capsular fracture. Extra-capsular fracture is said to be most frequent even the ages of thirty and forty; but Hamilton regards the liability proportionate to advancing life, and that age may be considered as the *and predisposing cause*." The age of the patient and the generally great and severe violence associated with the production of extra-capsular fracture, will *aid in distinguishing* it from the intra-capsular.

Union by bone takes place readily, and especially with an impacted fracture. The callus is deposited, almost invariably, along the inter-trochanteric lines; and also, not unfrequently, along the lines of the fracture of the trochanter. This callus is abundant and irregular, presenting as spines and tuberosities; forming a knobby and spiculated mass, which *embraces the upper fragment*. Osseous buttresses sometimes reach even to the bones of the pelvis. The use of the limb may be restored in six or eight weeks; but lameness still continues, and with impacted fracture, the limb being shortened, this condition is *permanent*. Sometimes the union of extra-capsular fracture is attended with depression of the neck, resulting in a proportionate shortening of the limb.

TREATMENT.—The *long splint*, with *weight-extension* from the foot, is here the most appropriate mode of treatment. A bandage or padded cloth may be applied around the pelvis, underneath the splint, to retain the trochanter, often comminuted, in position.

IMPACTED fracture should be treated by means of the splint for retention, as the limb cannot be extended to its original length.

(3.) FRACTURE THROUGH SUMMIT OF GREAT TROCHANTER, OR OF THE EPIPHYSIS.—I have found only one apparent specimen of this form of fracture, or perhaps separation of the *epiphysis*, it having occurred in a child, aged fourteen, from direct violence—a fall on the hip. (See Diagram, p. 16.) Dr. Roddick, of Montreal, Canada, has, I believe, met with another instance of this form of trochanteric fracture. These cases of epiphyseal fracture are supplemental to those mentioned in other works; recorded by Key (in Cooper's treatise), and another by Hamilton.

The SIGNS are well marked, but for the considerable swelling which usually attends this trochanteric fracture; direct violence being the cause. The trochanter is drawn upwards and backwards, away from the shaft of the femur. *Flattening of the hip*, therefore, although *caused by swelling*, may be felt by firm pressure with the hand; while, *stiffness and crepitation* may be detected on *abducting and rotating* the limb; the femur moving, the trochanter remaining stationary. In addition to these three hip-signs, there is *some eversion* of the limb, but *without any shortening*; and thus fracture of the great trochanter alone, may be distinguished from extra-capsular fracture of the femoral neck. These two injuries, however, are often associated; or sometimes fracture below the trochanter co-exists.

The Treatment will be noticed in that connection.

COMPOUND FRACTURE OF THE NECK OF THE FEMUR is a very formidable injury, resulting almost exclusively from gunshot wound.

The TREATMENT is that for compound fracture, in general; hence, according to the condition of injury, retentive appliances may be used, excision of the splintered portion, or amputation of the hip, resorted to. Experience has shown that *any attempt to preserve the limb entire*

will be almost hopeless, and amputation utterly hopeless; excision, therefore, remains as the only justifiable resource, followed by retention of the limb in the best position for union.

Fracture of the Shaft of the Femur.—The *situation* of the fracture is, commonly, in the middle third of the shaft, and its *direction* is downwards and inwards or outwards; or downwards and forwards in the lower third; and varying in the upper third; transverse in children the bone may be not unfrequently comminuted. *Displacement* of the lower fragment occurs, upwards and inwards, somewhat behind the fragment, and with some rotation outwards. This displacement is produced by the adductor muscles. The upper fragment is drawn outwards forwards by the conjoined psoas and iliacus muscles, inserted into the small trochanter; and outwards by the external rotators.

The *Signs* of oblique fracture in the shaft are—deformity of the limb corresponding to the displacement, and occasioning a *muscular fulcrum* on the inner, and less so on the outer, aspect of the thigh; *mobility* and *crepitus*, on extending and rotating the limb; *shortening*, to about an inch, but increasing with muscular action, and *some eversion*; *pain* on inability to use the limb. *Transverse* fracture, in children, is accompanied with *angular* deformity; the ends of the fragments are completely displaced, and hitching on each other. The other signs are the same, differing only in degree from those of oblique fracture in the adult.

CAUSES.—*Direct* violence undoubtedly may be regarded as the only mode of fracture in any portion of the shaft; unless it be immediately above the condyles or immediately below the small trochanter. The passage of a carriage or cart across the thigh, or the fall of a person on the limb directly on it, represent the occasions of fracture. *Indirect* violence, as a fall on the feet or an indirect blow, may, indeed, occasion fracture of the shaft; but, more commonly, the bone just above the condyles is broken by the small trochanter.

Bony union takes place, usually, in the course of about six weeks or two months; but rarely, if ever, without some overlapping of the fragments and proportionate *shortening* of the limb.

TREATMENT.—Many plans of treatment have been devised, and many forms of retentive apparatus contrived, for the treatment of fracture of the Femur.

(1.) A *long external splint* is applied simply to steady the limb; the coaptation is secured by the application of four short splints to the limb according to Dr. Gurdon Buck's method; counter-extension is maintained by the weight of the trunk, the foot of the bed being elevated to the height of a few inches, sufficiently for this purpose, and a *weight* is brought to bear by means of a *weight* suspended over the limb from the leg, to which it is attached by a loop of adhesive plaster.

This is applied by passing a long, broad strip of stout adhesive plaster down one side of the leg and up the other side, leaving a loop over the sole of the foot. Within this loop, a thin plate of wood is placed, to the plaster, taking care that this stirrup be sufficiently *wide*—about two inches across—to keep off any pressure from the bands over the ankle, during the continued extension. These extension-bands are further secured by the turns of a roller-bandage from the foot to the

t, from about *three to ten pounds* for an adult, is attached to the middle of the loop by a small cord, and thus suspended over a wooden upright frame or standard at the end of the bed. The weight necessary for complete extension may not be tolerated well at first, and must then be moderated for a few hours. Sometimes the patient's continued extension will be relieved by slightly flexing the knee, and placing a small pillow underneath the joint. Of course, the length of the splint must be ascertained, when the fracture has thus been set, and applied daily afterwards; the extending weight being regulated ac-

cording to the position of the limb, may be resorted to in case of injury to the soft parts on the back of the limb, associated with a fracture of the femur. The suspension may be directed *obliquely* towards the knee, thus to more effectually maintain extension, while counterbalanced by the weight of the trunk.

If the *great trochanter alone* (see Fig. 16) would not require the limb, which of course is not shortened. In such case, a *bandage* may be applied, and will suffice to keep the fragment in position. But, in most cases, there is the additional injury of fracture of the neck of the femur, or in the adjoining portion of the shaft near the greater trochanter. Practically, therefore, the trochanteric fracture is treated with the treatment of these fractures. The additional injury of a hip-bandage may, however, be advantageous, whenever the limb can be felt distinctly movable; an uncommon condition, for in most cases of fracture is obscured by the large swelling which arises from the violence of the injury.

In case of the shaft of the femur *near the small trochanter* (see Fig. 17), the limb may be adjusted more evenly by *relaxation of the muscles*, and the application of a splint to maintain the requisite position for that method of treatment proposed and practised by Pott. The patient lies on the abdomen, and the leg upon the thigh, and the limb is secured on its *outer side*; an *angular splint*, moulded to the hip and thigh, is then be applied, and, perhaps, a short counter-splint on the inner side of the thigh. Both are secured by a bandage.

In case of fractures of the thigh are best treated by means of two splints, one for either limb, with an intervening crossbar to separate the legs a little. Thus the restless little patient is restrained from rolling about, and the perinæum can be more easily protected from prevent excoriation.

Of the Lower Articular End of the Femur.—The fracture is, generally, transverse; or either *condyle* may be broken, resembling fractures of the Lower Articular End of the humerus. These fractures also involve, or extend into, the *knee-joint*. Displacement of the lower fragment backwards is produced by the action of the *extensor* muscle. Separation of the lower *epiphysis* has been met with, as verified by dissection.

The symptoms are, usually, clearly perceptible; some *deformity* corresponding to the displacement, *mobility*, and *crepitus*; pain, and loss of power in the limb.

A fracture in this situation is liable to occur.

Indirect violence, as by a fall on the feet, may detach the

epiphysis, transversely from the shaft, in childhood or youth. violence, as by a fall on the knee, or kick of a horse, may fracture condyle.

Union by bone commonly takes place.

TREATMENT.—A *flexed position of the knee*, supported by the *inclined plane* or McIntyre splint, thus to relax the gastrocnemius perhaps the most effectual plan of treatment in these fractures inflammatory swelling of the knee-joint—concomitant with fracture or into the joint—must be subdued by cold lotions or irrigation. motion should be used, as soon as the union will bear it, to ankylosis.

The *starched*, or plaster of Paris, bandage will be appropriate treatment of *any* fracture of the femur—as in all other fractures when retention, without any extending force, may be sufficient. therefore, be found very useful, after consolidation has taken place finish off the union, without further confinement to bed. Or, if employed from the commencement, in children and infants; w ordinary apparatus cannot well be applied or continued.

Compound Fracture of the Femur—often comminuted—usually, from direct violence, as severe contusion or gunshot injury.

TREATMENT.—The rules of treatment for Compound Fractures general are here applicable; whether with regard to preservation of limb intact, excision of splintered portions of bone, or amputation amount of injury to the soft parts—integument, cellular textures, vessels, and nerves—as well as the fracture itself, mainly determine questions of treatment.

With the view of giving the limb its chance, the fracture has reduced, a long splint should be applied, as for simple fracture; but however, being “interrupted” opposite the injury, to facilitate application of dressings. *Amputation* may prove successful in the middle of the thigh, but never at the hip-joint.

Compound fracture, involving the *knee-joint*, necessitates *extremity* amputation, primarily, or secondarily, when excision has failed.

Fracture of the Patella.—In fracture of the patella, the fracture is generally *transverse*, and across the middle, or some upper rim only of the bone. *Longitudinal* fracture may occur *minutely* more frequently, the bone being starred and broken into tolerably equal pieces. The upper fragment is drawn upward by traction of the triceps extensor muscle; the lower fragment, fixed by ligamentum patellæ, remaining stationary.

The *signs* of fracture are sufficiently obvious; a depression into which the finger readily sinks, between the two fragments, perceptibly when the joint is flexed; *mobility* of the fragments probably some *crepitus*, when the limb is extended. Pain may be considerable, but marked *inability to raise the limb*, in addition to these signs, can never be overlooked. Fracture of just the upper rim of the patella, with any rupture of the aponeurotic capsule of the joint, will probably be *these signs* obscure; the crest-piece of bone not being drawn up into the concavity between the condyles of the femur, the patella, itself apparently entire.

Muscular action is the most frequent cause, in

Transverse fracture. A person falls backwards, the knee is bent, and the patella snaps—as the tendon of the triceps extensor might be ruptured—by the sudden strain thrown on that muscle in the effort to regain the upright posture. But the fall is completed because the patella gives way, and the bone is not broken by falling on it. This accident happens more commonly in men, and in adult life than childhood. In like manner, after fracture of one patella, the other is more liable to be broken by muscular action; increased strain being thrown on the triceps muscle of the other leg, in any similar effort of self-preservation. Both patellæ have been known to snap simultaneously. *Direct violence*, as by a fall on the knee, is the occasion of *longitudinal*, and, more especially, of *comminuted* fracture. *Considerable swelling* speedily ensues from effusion into and around the joint, in connection with fractured patella, whether produced by muscular action or by direct violence; and this is associated, in the latter case, with marked discolouration. The signs of fracture are more or less obscured.

The mode of union in fracture of the patella may be either ligamentous or osseous; the difference depending probably on the less or more complete contact of the fragments, during the process of union. *Ligamentous* union usually takes place in *transverse* fracture; with rare exceptions, where osseous union may occur, nearly complete contact having been maintained. Union by ligament will form even when separation of the fragments extends to an inch and a half; beyond this distance, thickened aponeurotic fascia serves as the only bond of connection. Thus the fragments may remain severed to an extent of four or five inches, and often become enlarged. *Osseous* union, apparently, takes place more frequently in *longitudinal* and in *comminuted* fractures of the patella, the fragments remaining in apposition. *Necrosis* of the patella may ensue, after transverse fracture with ligamentous union; owing apparently to deficient vascular supply to the fragment affected.

TREATMENT.—The limb should be *extended*, and *flexed* on the abdomen, until the fragments would naturally fall together; and this position is maintained by a sufficiently *elevated inclined plane* on which the limb rests, and which is provided with a foot-piece. Any swelling or distension of the synovial capsule—any *synovitis*, consequent on the injury, having subsided, aided by an evaporating lotion, the fragments can then be brought into absolute contact. When, therefore, the swelling has diminished in the course of three or four days, the fracture may be readily, and painlessly, retained in position by the application of a *bandage* immediately above and below either portion of the patella, encircling the limb and splint in a *figure-of-eight* form, and tied together at the sides. The splint should be furnished with a hook above and below the popliteal space, to catch the turns of the bandage, and thus bring further pressure to bear upon the fragments. Or a *semilunar cap* of gutta-percha, just above the upper fragment, may be applied, with a *counter-cap* below the lower fragment, to steady it in position. This—the Author's apparatus, may consist of two stout leathern receptacles, secured by side-tapes.

An unusually large amount of fluid effusion into the synovial capsule, forming a tense and almost globular swelling, may be *aspirated*; and thus the patellar fragments can be brought together.

Malgaigne's *hooks* are a contrivance whereby the fragments can be

forcibly drawn together, and retained, by steel claws thrust into them just above and below them. If there be no risk of penetrating the joint with this instrument, violent synovitis is not unfrequently induced. The hooks will be found very serviceable, and safe, for fixing the lunar caps of gutta-percha, instead of being thrust into the bone; my method of employing this instrument.

Union will be so far secure in a month or six weeks as to allow patient to move about, guarded by a back splint, and starched bandage. It is not advisable to have recourse to this substitute apparatus in an earlier period; simply because the yielding ligamentous union will not be strained by any muscular action in using the limb, or the chance of osseous union be frustrated. Even after some six weeks have elapsed the ligamentous band continues to yield; and in the course of a few months may present an *interval* between the fragments of several inches, resulting in a tottering movement of the joint forwards, whenever patient stands or walks.

Under these circumstances, the operation of *wiring* the two parts of the patella together, has been occasionally practised. More recently the same method of treatment has been practised as a *primary operation*—in recent fracture of the patella.

Considering the safety and efficacy of the old method, even apparently resulting in failure—my own judgment decidedly inclines to the treatment of a simple fracture of the patella by bandage-retention of the fragments, in the manner already described; and I think that *wiring*, if practised at all, should be reserved for those quite exceptional cases in which the fracture remains *united*, as the final result.

Wiring is easily performed. An incision—longitudinal or transverse—lays bare the fragments; the edges should be pared, if necessary, to expose fresh bone; they are drilled in two places, exactly opposite each other in either fragment; and taking care not to penetrate the cartilaginous surface of the patella—so that the sutures shall be *extra-articular*. Silver wires are then passed through the holes, and tightened, thus pressing the fragments in contact. The incision-wound being closed with wire sutures, the patellar sutures are clipped off above the level of the integument. A drainage-tube is inserted through the outer part of the joint—to secure a dependent opening. The limb should be put in a back splint and elevated. Antiseptic gauze-dressing is then applied. When osseous union has taken place, the *sutures* must be removed, as, if all goes well, the wound will have soundly healed, this necessitates reopening it sufficiently to snip the wires and extract them from the patella. This concluding part of the operation was, therefore, made by Van der Meulen, of Utrecht. Before closing the wound, the suture having been twisted, the ends may be *cut off short*, and the ends hammered down—thus leaving a foreign body beneath the integument, which, however, may remain quiescent. In a case of recent fracture of the patella, at the age of forty-five, bony union and perfect motion were obtained after four months.

Professor Volkmann has devised an analogous operation to that of *wiring*, the fragments, but differing in two important particulars. The two parts of the patella are maintained in contact by means of *staples* inserted *subcutaneously* through the *extensor tendon* and *ligamentum*

he has thus succeeded in obtaining osseous union in several

Fracture of the Patella rarely occurs alone. It is usually comminuted, with great injury to the joint; and results in violence of severe character, as some crushing force, or gunshot. On the other hand, the joint may be opened, but not otherwise than by an incised wound, with an axe, hatchet, or other cutting instrument, or by a lacerated or a gunshot wound.

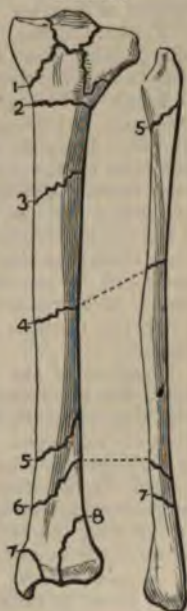
EXT.—1. In compound fracture, *uncommon* fracture of the articular ends of bone of the knee-joint, *preservation* of the joint, with ankylosis, should always be tried, in some instances. The operation of wiring the fragments together, under antiseptic precautions, is, however, especially applicable. The wound is usually closed with sutures. In the event of non-union, free incision must be made, and a flap must be used. If the fracture be much comminuted, removal of any loose fragments is inadvisable; but attached fragments had better be left, to regain adhesion, perchance, or be the cause of purulent suppuration. Failing to save the joint, the operation of useful ankylosis, *excision* should be resorted to, secondarily, that by sacrificing the limb may still be preserved. 2. The *operation* of fracture—when the articular end of the tibia, or of both bones, is involved, is submitted to primary excision of the articular ends, and extensive crushing of the bones of the leg is the only condition which renders *amputation* necessary, and, of course, it is the only resource, *excision* being the only operation, whenever excision has

excision seems to be a not uncommon mode of fracture of the compound fracture of the patella, and when comminuted.

Fractures of the Leg.—(1.) Fracture of the

Fibula, or of either Bone singly.—(Fig. 19.) The *direction* of fracture is usually transverse in the upper part of these bones, in the tibia; or it may be comminuted, and extend into the knee-joint. In the middle or lower part, the fracture is commonly oblique, or perhaps less frequently comminuted. These differences are due to the causes of fracture, above and below. *Displacement*

FIG. 19.*



Fractures of Tibia and Fibula. Diagram showing situations and lines of fracture, chiefly from specimens in the Museum of St. Bartholomew's Hospital.—1. Fracture comminuted into knee-joint (St. George's Mus., 1, 199). 2. Fracture of tibia, middle third, and the fibula, middle third, and the tibia, lower third, and below head of fibula. 6. Above ankle-joint, in fibula. 7. Internal malleolus, and lower end of fibula, or Pott's fracture. Lower end of tibia, into ankle-joint (St. Bart. Hosp. Mus., C. 22). 8. Fracture of tibia, 7, as in Tibia. (Author.)

...the fracture is complete, and the bone is broken into two or more pieces. The fracture may be complete or incomplete, and may be comminuted, that is, broken into three or more pieces. The fracture may be simple or compound, and may be open or closed. The fracture may be fresh or old, and may be recent or remote. The fracture may be stable or unstable, and may be displaced or undisplaced. The fracture may be comminuted, that is, broken into three or more pieces. The fracture may be simple or compound, and may be open or closed. The fracture may be fresh or old, and may be recent or remote. The fracture may be stable or unstable, and may be displaced or undisplaced.

Fracture of the tibia or fibula, singly, is slight, and less pronounced than in the case of bone supporting the distal bone. In fracture more serious signs are shown down the bone, the swelling and the mobility and crepitation. A fracture of the tibia in its upper third, per se, is not fatal, while the bone is in place. By drawing the finger over the finger from the fracture may be rendered perceptible.

Causes.—Direct violence seems to be the cause of these bones in their upper part. Any crushing wheel passing over the leg, or a fall between carriages, may thus be the occasion of fracture: at the same height, and transversely or obliquely, acts in like manner. Indirect violence is produced by fracture lower down. A fall or blow, or striking on the leg, may thus be the cause of fracture lower down. A fall or blow, or striking on the leg, may thus be the cause of fracture lower down.

unfrequently changed; the lower part having fallen backwards, or inclining inwards, occasionally outwards, or forwards.

TREATMENT.—The fragments having been brought into apposition by moderate extension, aided by sufficient flexion of the knee, and of the thigh on the abdomen, the leg may be laid in McIntyre's *double-inclined plane splint*, properly padded. This position of the limb overcomes displacement of the upper and lower fragments, as arising from muscular action; but displacement of the lower fragment, owing to any dropping of the leg, is still further counteracted by supporting the foot in a short sock with a tape attached to the toe, which is wound round a brass button over the end of the foot-piece of the splint. A roller is then applied around the foot and this portion of the splint to maintain extension, and continued around the leg and splint, upwards to the lower part of the thigh, or interrupted, if the fracture be compound. A cradle is placed over the leg to raise the bed-clothes.

A more comfortable arrangement, and equally efficacious, in relation to the union of fracture, is to suspend and swing the limb in a case of tin or wood, secured by cross straps; the limb being suspended by a chain from two pulley-wheels which run upon a horizontal bar, supported by a light iron frame. Such is Salter's cradle-swing apparatus. A double motion is thus allowed: a lateral swing, for ease of position to the body; and a motion in the axis of the limb, for the prevention of longitudinal displacement of the fragments, by any downward shift of position telling in that direction.

Various other apparatus have been designed for the adjustment of fractures of the leg.

A *fracture-box*, consisting of three splints—a leg-rest with foot-piece, and two supporting side-pieces—may be used and swung in like manner.

The *wire side-splints*—devised by Bauer—form a very simple and efficient apparatus, padded with cotton wadding. They can be readily adapted to the form of the leg, and thus keep the fragments well adjusted. But I would recommend the additional prolongation of both splints around the sole of the foot, forming a foot-piece. A roller-bandage, carried up the leg, will secure the whole in position.

Plaster of Paris splints, as modified by Mr. Croft, answer the same purpose. Two side splints are used, instead of one encircling the limb, as in the ordinary "immovable apparatus." Each splint consists of two pieces of flannel cut to the form of the limb,—conveniently from the patient's stocking, and of sufficient width to leave an interval of half an inch between them, before and behind. The inner piece of flannel is overlaid by the outer piece, soaked in wet plaster of Paris the consistence of cream. These splints are applied in a moist state, and moulded to the limb; and are then retained in position by a muslin roller-bandage. The interval between the splints allows of the relief of tension, by slitting up the layer of muslin bandage in front, the intermediate layer behind forming a hinge for the readjustment of the splints. Another muslin roller is then applied.

Fracture, very oblique, or comminuted, may occasion some difficulty as to the retention of the fragments in apposition. It is here that *division of the tendo-Achillis*—Laugier's proposal—may be practised,

with the view of correcting the displacement arising from muscular contraction.

(2.) **Fracture of the Lower Ends of the Tibia and Fibula, or of either Bone singly.**—Five forms of fracture are liable to occur near the ankle-joint:—(1) fracture of the lower end of the *tibia*, obliquely from without downwards and inwards, and of the *fibula*, about three inches above the ankle; (2) fracture of the *fibula* about three inches above the ankle, with the tip of the *internal malleolus* of the *tibia*, this double fracture constituting *Pott's Fracture*, a very common form; (3) fracture of the *fibula* two or three inches above the external malleolus, with rupture of the *internal lateral* or *deltoid ligament*; (4) fracture of the *internal malleolus* of the *tibia*; (5) fracture of the *articular end* of the *tibia*, involving the ankle-joint.

Dislocation takes place, not unfrequently, in connection with each of these fractures, and with that in particular of the *inner malleolus alone*; which, I believe, seldom happens without, and from, dislocation of the *tibia* outwards.

SIGNS.—*Deformity* is presented, corresponding to the displacement of one or both fragments, with, perhaps, dislocation; and *mobility*, with *crepitus*, are discovered on handling the part.

(1.) Fracture of the lower end of the *tibia* obliquely, and of the *fibula*, produces a notably *increased breadth* of the *ankle-joint*, between the malleoli, with some eversion of the foot, and obliquity of its axis, the toes being turned outwards and the heel inwards.

(2.) Fracture of the lower end of the *fibula*, and of the *internal malleolus*, or *Pott's fracture*, is accompanied with a very notable *eversion* of the *foot*; the sole being turned somewhat upwards, as well as outwards, so that the outer edge is directed upwards, and the inner side downwards, on which the patient rests.

CAUSES.—*Indirect violence* is certainly the more common cause of these Fractures; either by a fall or jump from a height, breaking the *tibia*, and *fibula* secondarily; or by violent eversion or inversion of the foot, breaking the *fibula*, with the *internal malleolus*, or rupturing the *deltoid ligament*; or snapping off the *inner malleolus alone*.

Union of fracture—not involving the ankle-joint—takes place readily; and without any appreciable displacement, under proper management and supervision.

TREATMENT.—In *all* these Fractures, *McIntyre's double-inclined plane splint* will be found a most efficient means of retaining the fragments in position; and the more so proportionately to their mobility. The trough in which the leg rests steadies the upper fragments; the foot-piece counteracts any tendency to twisting of the foot inwards or outwards; and the *sock* supports the heel.

Plaster of Paris splints—one on either side of the leg, securing the foot, answer admirably; care being taken to keep the foot straight, during the *setting* of the splints.

Any marked tendency to eversion of the foot, as in *Pott's fracture*, may be more effectually restrained by *Dupuytren's splint*: a *short, straight splint* applied to the inner side of the leg, from the knee to the foot. A *pad* should be doubled just above the *inner malleolus*, and a roller wound round the foot and splint in a figure-of-eight form, thereby drawing

inwards over the thick pad as a fulcrum, and the roller is then rolled upwards to the knee to steady the splint. Some tendency to dislocation of the ankle-joint must be met by timely recourse to passive exercise, and relapsing swelling may require the support of a bandage for a considerable period.

Compound Fractures of the Leg, and of the Ankle-joint.—In the former situation, compound fracture of the Tibia and Fibula, or of the tibia alone, happens more frequently than similar injury of any other

bone in relation to the ankle-joint, compound fracture presents no differences of clinical importance. The same considerations guide as to the preservation of the limb, excision, and amputation.

Fractures of the Tarsal, Metatarsal Bones, and Toes.—These are liable to both Simple and Compound Fractures, and with all the signs of such injuries.

The **ASTRAGALUS** is very seldom fractured, without fracture of other tarsal bones. The line of fracture may be transverse, or longitudinal, or oblique, or horizontal, sometimes attended with comminution; and with, or without, impaction of the fragments. Usually, the injury is complicated with dislocation of the foot outwards, or inwards, and with fracture of the tibia. Generally also, the dislocation is compound.

SIGNS will be some *crepitation* and *mobility* of the fragments, the foot being extended and the foot, backwards and forwards; but there will be no displacement—the bone being held in position betwixt the tarsal arch and the calcaneum, although sometimes the upper fragment is driven up and wedged between the ends of the tibia and fibula. As associated with *dislocation*, the additional signs of that injury will also be presented.

CAUSES.—*Indirect* violence seems to be the more common cause of fracture through the astragalus, by a fall from a height on the feet; rather than by direct force, crushing the foot.

TREATMENT must be guided by the amount of injury. Thus, the reduction of displacement can sometimes be accomplished, and then retained in a McIntyre's splint; but *excision* of a displaced fragment is necessary, when it cannot be reduced and kept in position; and *amputation* of the foot is the only resource of treatment for a crushing

compound fracture of the astragalus, with perhaps protrusion of a displaced fragment, may be produced, partly by the displacement, but chiefly by the violence of the injury. This condition of fracture only admits of *amputation*.

Fracture of the Os Calcis presents particulars worthy of notice. The bone is broken transversely, or comminuted occasionally, with perhaps displacement; and the line of fracture may be either *behind* the lateral process, or through the *body* of the bone. In the *former* situation, there will be some displacement, the posterior fragment being drawn outwards by the muscles of the calf; in the *latter* situation, this fragment is held in position by the lateral ligaments and the strong interosseous ligament.

SIGNS of this fracture vary accordingly. *Marked flattening* of the foot on its plantar aspect, or even a *depression* upwards, and projection of

the fragment posteriorly, with *mobility* and *crepitus*, denote fracture *behind* the lateral ligaments; of which injury I have had one well-marked case. Comparative *absence* of these *signs*, and particularly of the deformity of the heel, denotes fracture more *anteriorly*, or that across the body of the bone.

CAUSES.—*Direct* violence is, probably, the only cause of fracture; as by a fall from a height, the person alighting on his heels, or by a cart-wheel passing over and crushing the foot. Very rarely, the *os calcis* may be broken transversely, by the powerful action of the muscles of the calf, in jumping or falling on the toes.

TREATMENT consists, as usual, in the adjustment of the fragments, with relaxation of any opposing muscular action; and their retention in position. A *gutta-percha* or pasteboard *splint* must be contrived according to the fracture; and, when necessary to place the leg in the flexed attitude, with the heel drawn up, this position may be maintained by the apparatus used for rupture of the *tendo-Achillis*. Or, the tendency to displacement and the more severe contusion may require the support of a McIntyre's splint, used as a *double-inclined plane*. In this, and other fractures of the tarsal bones, passive motion should be employed in time to prevent ankylosis.

Compound fracture generally allows only of excision or amputation. But—as in regard to the hand—the removal of any portion of the foot should be guided by great circumspection and judgment; having due regard to the extent of the injured part, and the preservation of this valuable member.

CHAPTER XXIX.

DISEASES OF BONE.

Inflammation of Bone.

BONE, or the *Osseous tissue*, with its investing *Periosteum*, and the *Endosteum* or *Medullary Membrane* of long bones, are, *severally*, subject to Inflammation. But the pathology of Inflammation as affecting each of these structures is intimately associated, and they are commonly affected simultaneously, or consequently. It will, therefore, be more natural to describe in order, first, the structural alterations pertaining to Osteitis, Periostitis, and Endostitis, and then their diagnostic characters, causes, consequences, and treatment.

(1.) **Osteitis, or Inflammation of Bone.**—The *cellulo-fibrous network*—the organic basis of the lamellæ in the compact and cancellated structure of Bone, with the *vascular network* ramifying in the Haversian and cancelli, is alone the *seat* of inflammation; the *inorganic* cradled to the fibrous network in the process of ossification, subject to any perversion of nutrition or other vital change.

1. The *blood-vessels* become enlarged—as shown by Von Bibra—giving an injected red appearance to the portion of bone undergoing inflammation; and the *fibrous matrix*, probably, passes into a state of fatty transformation, as in inflammation of most other textures. The *inorganic* or *earthy matter* undergoes merely a disintegrative separation from the fibrous matrix with which it was intimately connected, but retains its chemical composition, and is then absorbed. Such are the *earliest* structural and chemical alterations in the inflammation of bone.

2. A change of consistence—*softening*—accompanies this fatty liquefaction of the organic matrix and unloosening of the inorganic matter. But the *Haversian canals*, *lacunæ*, and *canaliculi* soon become the seat of disintegration and *absorption*, whereby these natural cavities are rendered more conspicuous under the microscope; or, opening into neighbouring cavities, *irregular spaces* are formed. The compact structure thus acquires a rarefied or porous character, presenting the appearance of *cancelli*; while the cancellated portion is exaggerated; as in the neighbourhood of necrosis or death of bone, when consequent on inflammation.

3. Within these spaces the fatty matter and earthy salts—*detritus* of the osseous tissue—accumulate; and the *products* also of inflammation are deposited. They consist of plastic lymph, with emigrant pale blood-corpuscles, or pus; the one kind of deposit resulting in *induration* and *hypertrophy* of the bone, the other in increased *softening* and disorganization. In the medullary texture, many of the new cells are of large size, and contain several nuclei—like myeloid corpuscles in growing bone, and the fat-cells lose their contents.

The description of these changes belongs to the consequences of Osteitis.

SCROFULOUS OSTEITIS structurally resembles simple inflammation of bone; the osseous substance being disintegrated and absorbed. Thence the bone is light, soft, and oily. But the rarefied cancelli or spaces in the compact texture are filled with peculiar products; a *red jelly-like matter*, or occasionally, a deposit of *tubercle*. The former is always diffused. The accompanying *chemical changes*—according to Dr. Black's analyses—consist in a considerable increase of fat in the diseased bone, a large diminution of the salts of lime, a diminution of the organic matrix, and an increase of the soluble salts. Associated with these destructive alterations, minute projections of bone from the walls of the cancelli evince an attempt at osseous reproduction, thus corresponding to the induration or sclerosis which results from simple inflammation of bone.

TUBERCLE in bone may be either diffused or circumscribed; the latter form being comparatively rare. *Diffused* tubercle occurs commonly in the shaft of long bones, or in the bodies of the vertebrae, and more often of the dorsal or lumbar region of the spine. It occupies the cancelli, and appears as a nodulated, or granular, yellowish mass of soft consistence; extending frequently along the whole length of the shaft. Regarding this as scrofulous matter, Virchow and Billroth would restrict tubercular deposit to the form of greyish, somewhat transparent and firm granulations,—the miliary tubercle, so called. *Circumscribed* tubercle is deposited most frequently on the outside of the skull, beneath the periosteum, constituting the *strumous node*; and scarcely less frequently, in the cancelli of the articular end of a long bone, usually the tibia. Tubercle in bone sometimes becomes actually *encysted*.

en. *Enlargement* of the bone at length becomes perceptible; *edematous swelling*, perhaps *some redness*, and *tenderness* of the it. This swollen state of the integument renders any enlargement of the bone more apparent than real. Softening of the bone, in solution of its substance, may eventually be detected on pressure; diagnosis will be sufficiently obvious, without subjecting the patient to the pain of such examination. Inflammatory fever, of varying intensity, accompanies these local symptoms.

Acute OSTEITIS is attended with more considerable *enlargement* of the bone and of an *indolent* character. The surrounding integuments become *red*, *white*, and *painless*; becoming somewhat red and tender, suppuration supervenes. The concomitant symptoms of scrofula will confirm the diagnosis.

Chronic OSTEITIS must be diagnosed entirely by the concurrence of the past symptoms of Syphilis.

GUMMATOUS OSTEITIS.—The symptoms are similar to those of osteitis, but more extensive and superficial. A *painful, puffy swelling* is presented, subject to exacerbations, and the swelling *acquiring* a *bony* character.

These diagnostic characters are well illustrated by an *osteitic node* in a subcutaneous bone, as the *skin*; or, not only, in other bones—the frontal, clavicle, or sternum. A *node* differs especially in two characters; the swelling is almost entirely *scarcely tender* on pressure; and it slowly undergoes *ulceration*—disclosing an ash-grey, sloughy lump, as of matted cellular tissue at length exposing the bone in a carious state; the integument having irregular, undermined edges or flaps, with a *bluish* discoloration. The ulcer is very intractable.

The periosteal gumma atrophies and disappears. Although attended with the febrile disturbance of a common painful node, the swelling is attended with the usual constitutional cachexia of Syphilis. This growth often attains to a larger size than a syphilitic node; nearly embracing the tibia perhaps, it imitates the appearances of a sarcomatous or encephaloid tumour.

PERIOSTITIS is not characterized by any peculiar symptoms, apart from osteitis.

In the inflammation of other parts, osteitis and periostitis may be regarded as *acute* or *chronic*, according to the more or less severe nature of the symptoms, and their duration. In the latter or chronic periosteal or periosteal inflammation, the patient, worn down by long-continued pain and sleeplessness, presents the constitutional symptoms

of Syphilis.—Inflammation of bone usually results from *external* violence or exposure to cold or damp; but it arises under the influence of a predisposing *constitutional* condition of disease. These predisposing causes comprise secondary or constitutional syphilis, or the excessive use of mercury—of rare occurrence nowadays; the scrofulous taint; fevers; and probably other conditions affecting nutrition. The causes—the traumatic or the constitutional—may be *alone* sufficient to induce osseous inflammation. The bones most liable to inflammation are, however, those most exposed to the action of external

agents. Hence, the tibia, cranium, and especially the frontal bone, the clavicle, sternum, ribs, and bones of the foot and hand, are most commonly affected.

Consequences.—(1.) *Absorption and rarefaction* of the bone having taken place, the osseous texture may be found in this state, before the supervention of much deposit—representing the *osteoporosis* of Rokitzsky, or a form of *atrophy* as affecting bone. (2.) *Induration, or sclerosis*, represents an increasing deposition of plastic lymph, and its ossification results in considerable thickening of the substance of the bone—*hypertrophy*, with perhaps irregular osseous deposit on its free surface. *Elongation* of a long bone is, sometimes, consequent on its inflammation. The tibia has thus become longer than its fellow by nearly two inches. (3.) *Suppuration* of bone; also *Caries*, or ulceration of bone; and *Necrosis*, which is analogous to sloughing or mortification of the soft textures.

Treatment.—(1.) In *traumatic and acute inflammation* of bone—whether in the form of *Osteitis* or *Periostitis*—the ordinary remedial measures for inflammation will usually suffice. *Warm fomentations*, leeches, and *rest*, with the administration of calomel and opium, are appropriate. Billroth strongly recommends iodine paint applied to the whole limb, continued until large vesicles form, and renewed when this vesication disappears. (2.) In *constitutional and chronic inflammation*, this treatment must be supplemented, or partly superseded, by the general treatment for secondary syphilitic affections, scrofula, or rheumatism. Iodide of potassium is thus often singularly efficacious in syphilitic or rheumatic osteitis or periostitis. Should the disease be, as frequently, of scrofulous character, then the patient must be subjected to the renovating influences principally of pure air, and sea-bathing—if it agrees—coupled with plain nutritious food, reinforced by tonics—especially the sulphate of iron and quinine, and the iodides of iron and of potassium, respecting the efficacy of which I know less. Cod-liver oil is an excellent adjunct both to our dietetic and medicinal resources. But whenever the osteal or periosteal inflammation is a manifestation of any constitutional disease, the recovery is very lingering, and the course of treatment will be protracted.

Tension and insupportable pain are more readily and permanently relieved by free *incisions*, than by any medicinal treatment. In periosteal tension, these incisions should be made down to the bone; in tension resulting from osteitis, an incision may be prolonged, by means of a Hey's saw, through the bone, down to the medullary canal. Trephining the bone has been resorted to for the relief of osseous tension. *Chronic thickening*, unattended with much pain, may be removed or lessened by the application of *blisters, iodine* and *mercurial ointments*. When depending on constitutional causes, chronic osteitis is often associated with caries or necrosis, and will necessitate one or other of the operative procedures for removal of the dead bone.

Suppuration of Bone.—Suppuration, in connection with bone, is liable to take place in either of the three situations described with reference to its site. It may be either *diffused or circumscribed*; and is definitely, *acute or chronic* suppuration. I use—(1) *OSTEO-MYELITIS, diffuse suppuration of the medullary canal and cancelli*; (2) *DIFFUSE*

s, and PERIOSTEAL ABSCESS; and (3) CIRCUMSCRIBED ABSCESS within either the cancellated or compact structure.

osteo-myelitis.—The results are disintegration of the *cancellated* and *diffuse suppuration*, the cancelli being found loaded with the *medullary membrane* is injected and often sprinkled with pus; the *periosteum* having become involved usually, shows more inflammatory hyperæmia and thickening, and is partly separated from the bone; but the osseous texture has not generally undergone appreciable change (Fig. 20). At this stage, in the larger bones, the disease usually terminates. Otherwise, the pus may penetrate into the joints, probably into the nearest joint, as in the case of central necrosis may ensue.

In *young persons*, suppuration is apt to commence in the *epiphysis*, as in the knee-joint; affecting the femur, or the head of the tibia, as one of the epiphyses is the seat of epiphyseal myelitis. The epiphysis becomes detached from the shaft, in a few days, or at a later period. Sometimes the epiphyses, upper and lower, are involved. If the disease is induced by myelitis—affecting the shaft and the synovial inflammation being of an acutely suppurative character, the joint is destroyed. Sometimes, the joint-abscess is the result of pyæmic infection from the myelitis.

During life—are neither absolute nor complete separation of the periosteum, with *diffused* suppuration of the bone, and *diffuse inflammation* of the periosteum, are equally the symptoms of osteo-myelitis. An *absence* of connection between the periosteum and bone is distinctive of osteo-myelitis; but this is often rendered obscure by the superimposed *œdematous swelling*.

On *detachment* of the epiphysis, there is often a loud crepitus, of the part, as in the case of dislocation may be produced by muscular contraction. But these signs are found to coincide with the occurrence of epiphyseal disjunction, the joint being unchanged. Perhaps a sinus-opening may be made by a probe into the detachment, and thus ascertain as to what has occurred.

In the event of osteo-myelitis supervening on amputation, the end of the bone sometimes projecting from a conical stump—presents a *fungoid*, pulent medullary membrane, projecting from the canal; the cancellous texture having a pale appearance, infiltrated with matter, and readily breaking down under the finger; while the articular and pulpy periosteum is detached and everted to some extent the ring of compact bone. On passing a probe up the canal, the membrane bleeds freely when the healthy portion is

FIG. 20.*



* St. Bartholomew's Hosp. Mus.

reached; thus indicating perhaps that a limited portion only of the bone is affected.

The CAUSE is usually some *injury* implicating the medullary mass and cancellated structure of the bone affected. Thus, osteomyelitis unfrequently follows compound and comminuted fractures, wounds, amputations, and other operations exposing the medullary canal.

It runs a *rapid course*, is commonly succeeded by *pyæmia* and thence terminates fatally.

TREATMENT.—*Preventive* measures afford the only reasonable chance of anticipating this issue. The ambiguous symptoms of diffused inflammation of a bone, with perhaps some oedematous swelling, will therefore warrant the Surgeon in ascertaining the state of the periosteum, to determine the diagnosis. Under these circumstances, an *early, free incision* should be made down to the bone. If the periosteum is discovered to be separated *without* any notable effusion between it and the bone, it will be just to *trepphine* the bone, with the view of giving exit to any matter that may have formed in the deeper cancellated structure. This procedure should generally be taken with *antiseptic* precautions; although, from experience, in an hospital under healthy hygienic conditions, no difference is shown any difference in favour of the treatment for osteomyelitis is conducted. Dr. H. Demme, of Berne, affirms that the liability to infection is greater in the more acute stage of the disease; accordingly he postpones incision until about the end of the second week, — merely painting the limb with *iodine-pigment* to beyond the boundary of swelling. The results compare most favourably with those of the

FIG. 21.*



incision—originally advocated by Chassaignac. In the case of the affected portion of bone,—as a stump of bone,—an *amputation* of the limb, must be had recourse to, if more extreme measures. I doubt, however, whether the limits of the disease can ever be so definitely determined, in the continuity of a long bone, as to warrant the partial operation of excision; and in the case of a limb, amputation should not be performed until the continuity of the bone, but above the joint, is destroyed. The bone affected with the diffuse inflammation of osteomyelitis.

(2.) *Diffuse Periostitis*—according to Mr. Paget's observations—appears to consist in the partial separation of the periosteum from the bone; by effusion of blood or other products on the surface of the latter. The *suppuration* soon spreads along the bone, *detaching* the periosteum, often from one end of the bone to the other (Fig. 21). At an early period, neither the periosteum nor the surface of the bone is visibly inflamed. The latter, indeed, may look white and bloodless, or so slightly worm-eaten; it yields, on pressure, large quantities of blood from the periosteal vessels passing into the bone.

Its superficial layers are more readily separable from the deeper layers, than in health. *Necrosis* is soon established, the whole of the bone becoming dead.

* St. George's Hosp. Mus.

the bone usually perishing; leaving the articular ends unaffected, and therefore *not* involving the neighbouring joint. Sometimes it does not escape. The long bones are more often affected than the flat or irregular ones; and, in the great majority of cases, the *femur* or the *tibia*.

SIGNS.—Arising insidiously, an *œdematous, painful swelling* is presented diffuse cellular inflammation—resembling acute fascial rheumatism. At suppuration soon following, the diagnosis is at once determined.

The **CAUSES** would seem to be some *injury* to the bone, occurring, however, in a scrofulous or weakly person. The disease is said to be met with more commonly about the *age of puberty*, and in boys more often than in girls.

It *rapidly* runs its course; *pyæmia* frequently supervenes and proves fatal; or the matter burrowing among the muscles, forms numerous *sinuous openings*, exposing necrosed bone. The dead portion is detached much sooner, apparently, than in ordinary necrosis; and *reparation* also seems to be equally active.

TREATMENT.—*Early and free incisions* are here, also, primarily important. During the process of cicatrization, injections of very dilute *chlorohydric acid* may be used, as highly recommended by Chassaignac, to cleanse the suppurating cavity and hasten exfoliation of the dead bone. A generally stimulating and tonic plan of treatment will be required to support life through this trying ordeal.

Periosteal Abscess.—Preceded, for a few days, by acute pyrexia, with *bone pain*, or a dull heavy sensation in the limb, and powerlessness,—*swelling* of periosteal abscess is characterized by its *abruptly circumscribed margin*, and *doughy consistence*, on deep pressure, obscured, however, by *superficially diffused œdema*. In the course of a few days, the skin becomes reddened, or assumes a brownish clay colour, and subcutaneous veins are well marked. The fluctuation of abscess is daily perceptible about the end of the second week. It may burst into a neighbouring joint, or *externally*, or in both directions.

TREATMENT in general is the same as for the diffuse form of suppurative periostitis.

Chronic periosteal abscess remaining, requires no special treatment.

3.) Circumscribed Abscess of Bone.—Always a *chronic* condition, this state of suppuration differs also from diffused suppuration, in limited extent, and in being distinctly circumscribed. The abscess, well defined, is seated within the *substance* of a bone, usually its cancellated structure; the cavity may be lined by a distinct pyogenic membrane, and the surrounding bone is more vascular than natural, thickened somewhat perhaps, and much indurated. The *size* of this abscess is never large, probably not exceeding that of a small chestnut, containing two or three drachms of pus, greenish yellow or dark coloured, sometimes mingled with caseous matter and *débris* of bone. If situated in one of the *long bones*, the abscess is commonly located at its *upper or lower articular extremity*, and very rarely within the medullary canal of the shaft. The *tibia* is most frequently affected, and its upper end near the knee-joint; its lower end near the inner malleolus, and in order of frequency; and among other bones, the lower end of the *ulna* near the elbow, and the *femur*, have severally been found the seat of circumscribed abscess.

SYMPTOMS.—*Pain* is at once the earliest and most significant. It is of a *heavy, aching*, and eventually *throbbing* character; more occasionally, or perhaps periodically—generally during the night—*persistent* for a considerable period—being probably of some duration. This pain is referred to a particular part of the bone extremity—in, for example, the head of the tibia; and a point of intensity can be discovered by careful palpation with the finger; the slightest pressure produces excruciating agony. A *small, puffy swelling*, or induration, surrounds this spot; and the skin adherent to the periosteum, without presenting any discoloration. Beyond this external appearance, little or no enlargement of the bone accompanies the remarkable pain of which the patient complains. There is an *absence* of any symptoms of *joint-disease*.

DIAGNOSIS.—The nature of this disease may, however, be mistaken for *chronic rheumatism*, or *periostitis*; or still more probably, for a *hysterical* affection. The *persistence* of the pain is the most distinctive character of circumscribed abscess of bone. But other local conditions may give rise to the same continued and wearing pain; as *tuberculosis* attends *central necrosis*, or *chronic osteitis*. Some enlargement of the surrounding bone, especially in the latter condition, with inflammation and thickening of the integument, will attract attention in these cases.

CAUSES.—This abscess can, sometimes, apparently be traced to injury, or exposure to cold. Early adult life seems to be the period liable; but the ages in recorded cases have varied from 13 to 50.

COURSE AND TERMINATIONS.—The abscess slowly enlarges, and the neighbouring *joint*, which thus becomes disorganized; and in addition to this result is evinced by synovial distension and swelling from time to time, after exercise. Or the abscess may open externally and discharge its contents with complete relief to the previous sufferer.

TREATMENT consists in *trephining* the bone over the seat of the abscess, and in thus giving vent to the pus. Chloroform having been administered, a crucial incision is made immediately over the painful spot, and extending down to the bone. A small trephine, having no rim to oppose its entry, is then applied, and worked through the bone; penetrating to some depth, and entering the cavity of the abscess. The circle of bone is detached and removed by an elevator or gouge, the pus evacuated. Or a drop may appear, and the bone must be treated further by the gouge until the cavity is entered. Some pus is discovered on raising the circle of bone; the exposed surface then be *pierced* in *various directions* to find a drop, and the osteotomy freely enlarged with the gouge. Otherwise, an abscess may remain undiscovered. A small bit of blackish, necrosed bone must have to be scooped out from the interior. But the cavity having fairly opened, the relief following the cessation of tension is instantaneous. Antiseptic dressing may be used during reparation; which proceeds uninterruptedly, a permanent cure is established.

An error of diagnosis even would be unimportant as regards the probable result of this simple operation. For if the disease proved to be *osteitis*, the removal of a piece of bone will relieve the bone to a healthier action.

Ulceration of Bone.—The term Caries has been

different morbid conditions of Bone. But the pathological identity of Caries and Ulceration is now generally acknowledged; and as such I use the term to signify Ulceration, modified only by the textural peculiarities of Bone.

Caries is essentially a disintegration of the osseous texture; and, like Ulceration of the soft textures, it may be presented in either of two forms—as enlarging a pus-discharging cavity or abscess in the *substance* of Bone, or as affecting the *surface* of a Bone.

Carious bone is *softened*, and easily breaks down under pressure with gritty resistance; it is porous, and infiltrated with a reddish-brown oily fluid, and granular inorganic matter—the *débris* of the disintegrated texture. Small detached masses of dead bone may be found associated with the carious bone. It has a *greyish, brown, or black colour*, but the surrounding bone is highly vascular. Beyond and around the carious mass, induration and hypertrophy may have taken place; the circumferential substance of the bone being dense, and presenting externally osseous nodules or spicula, with thickening of the periosteum.

In the *substance* of bone, the appearance of Caries is more marked in the *cancellated* structure, which is also more especially the seat of caries. Caries usually occurs in the *articular extremity* of a long bone; as that of

FIG. 22.



the *tibia* or *femur*, in *scrofulous* disease of the knee-joint affecting either bone; but scarcely less frequently, it attacks the bodies of the *vertebræ*; or the bones of the *tarsus* or of the *carpus*, in the foot or the wrist-joint.

FIG. 23.



On the *surface* of a bone, Caries presents a *drilled, worm-eaten* appearance (Fig. 22). The periosteum is loosened or detached, thickened, vascular, and villous. The projections, thus formed, pass from the under surface of the periosteum into corresponding depressions in the bone, its compact structure having acquired more the open character of the cancellated. The textural condition of the bone is similar to that already described as pertaining to deep caries. Superficial caries is more often met in the *cranial* bones, and as resulting from secondary *syphilis*, this form of caries attacks also the surface of the *tibia*, or of the *ulna*, affecting the subcutaneous parts of these bones.

The *Signs* of Caries are the characters of carious bone, as just described. Both forms of Caries, deep and superficial, are attended with *pain*, more

or less *deep-seated, redness and swelling* of the integument; followed by suppuration and the formation of abscesses. Any such abscess burst discloses the carious state of the subjacent bone, or leads to a carious cavity, as discovered by a probe. *Fistulous openings* remain, discharging unhealthy pus mixed with the granular detritus of bone (Fig. 23). In out-cropping, abortive granulations spring up; and the surrounding integument has a congested purplish appearance. Caries evinces a disposition to any reparative changes.

The CAUSES of Caries are those which produce *inflammation* of bone, especially as occurring under the influence of some constitutional condition. *Scrofula* and *Syphilis* thus not uncommonly affect the bones, in the form of Caries; the disease arising often, apparently, without external occasion of injury as an exciting cause.

TREATMENT.—The removal of any cause in operation is the prime rule of treatment in this, as in all other conditions of disease. Hence remedial measures appropriate for Constitutional Syphilis or Scrofula are requisite in most cases of Caries. Rest of the affected part is highly advantageous; but any topical applications, as counter-irritation, iodine, blisters, or issues, are useless, compared with constitutional treatment. In an *early stage*, the disease may thus be arrested and the bone restored to a healthy state. Or, under the influence of this treatment disintegration proceeds only so far as to gradually remove the affected portion by a gritty discharge; recovery then taking place by granulation.

Operative interference.—The diseased bone may be removed by excision, either of the affected portion only, or of the whole bone.

Excision of the carious portion.—The bone having been exposed by a crucial incision, the diseased portion must be removed piecemeal by means of a gouge. Various forms of this instrument are used, according to circumstances. The ordinary scoop-gouge is generally most convenient, and Marshall's rose-head osteotrite will often prove very serviceable in finishing off a carious cavity. The carious portion of the bone yields to the gouge with a *gritty resistance*; whereas the sound bone remains firm and vascular. The *extent* of bone to be removed may, therefore, be determined by these characters; portions of softened, crumbling bone should be scooped out, until the firm, rose-coloured bleeding bone is reached. During this procedure, which may take some time, the constant welling up of blood in the cavity, obscures the appearance of the bone and thus hinders the operation. The assistant, therefore, must constantly firmly sponge the surface after almost every movement of the instrument. This inconvenience and delay may be prevented by the previous application of Esmarch's bandage to empty the limb of blood, followed by the elastic coil to preclude the reflux entry of blood when the bandage is removed. The gouging is thus rendered bloodless, the bone having a yellowish appearance; and this might mislead the operator to proceed deeper than the softened and disintegrated or carious bone; but by slightly loosening the coil from time to time, it will be seen whether the *rose-coloured and firm bone* is reached. The surface or cavity, having this healthy character, is then dressed or plugged lightly with wet lint, overlaid with layers of dry gauze, and then the mackintosh applied as usual. The wound heals by granulation.

The *articular end* of a bone—affected by Caries—may require excision, as will be fully explained in treating of Diseases of the Joints.

Excision of the *whole* bone is rendered necessary by an extent of disease beyond the range of either of the previous partial operations, in the shaft or articular end.

Amputation is justifiable only under exceptional, and perhaps extreme, circumstances; where the caries is too extensive in connected bones to admit of excision, or when constitutional exhaustion has supervened. The foot, for example, may be removed for carious disease involving the tarsal bones, with perhaps prolonged discharge. When excision has failed, amputation is necessarily the last resource.

Necrosis.—The death of a portion of bone is analogous to Mortification of the soft parts; and it has the same pathological relation to Caries than Mortification has to Ulceration. Caries is molecular death or disintegration of the osseous texture; Necrosis, the death of a visible portion or mass of bone. Not unfrequently, both are associated in the same bone.

Necrosis—like Caries—may affect the *substance*, or the *surface*, of a bone. In the one form of necrosis, the dead portion is named the *sequestrum*, a term more particularly applicable when the piece of bone is loose and enclosed by a new bone; and when limited to the deepest portion of bone round the medullary canal, the *necrosis* is sometimes named *central*; while, in the other form, a superficial scale-like portion of dead bone is designated an *exfoliation*.

Necrosed or dead bone is smooth or rough, *hard* and *white*, or of a *yellowish* colour; becoming brown or black, and softened, when exposed to the action of decomposing pus and the air, from sloughing of the integument. It is *avascular*, not yielding any blood when wounded, and *insensible*.

REPARATION.—1. The *periosteum*, at first adherent, soon loosens its connection with the subjacent dead bone, and deposits *ossific lymph* between itself and the surface of the bone. This lymph-deposit undergoing ossification, forms a sheath of new bone over or around the dead portion, which thus becomes enclosed in an osseous case. The periosteum is the chief, but not the only, source of osseous reproduction in necrosis. But the original bone itself is an important source of new bone—by granulation—in the absence of the periosteal membrane, or in central necrosis; and the medullary membrane may contribute its share. The articular ends, in particular, evince a remarkable ossific power, when the shaft of a long bone is removed. Apart from the periosteum, when this texture is destroyed, the soft tissues around the bone may acquire the power of forming ossific deposit. The *dead* portion, at first continuous with the healthy bone at either end, loses its connection at the line of continuity; the living bone detaching itself from the dead, in a variable period of weeks, or perhaps months. The border of the living bone becomes more vascular, and has a succulent, ruddy appearance,—denoting an afflux of blood, as preceding the line of demarcation in gangrene of the soft textures. 2. *Ulceration* takes place at the line of continuity with the dead bone, the purulent discharge containing $2\frac{1}{2}$ per cent. of bone-earth, phosphate of lime, as shown by Mr. B. Cooper; or interstitial granulations are produced, by which a slight amount of bone is consumed, as Billroth states. A *groove* is thus formed around the junction of

the dead portion of bone; and this groove deepening, at length completely detaches it. Pus collects around the sequestrum, and interrupting the complete formation of the periosteal sheath of new bone, leaves apertures therein—one or two to four or five in number—the closer, through which sinuous tracks between the sequestrum and *staleous* opening in the integument become established (Fig. 24). These orifices meet with large, oblique granulations. At length the sequestrum becomes complete, and encased in the cylinder or involucrum of new

FIG. 24.*

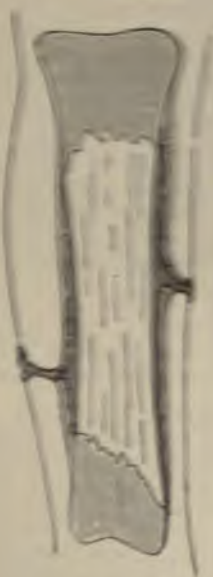


FIG. 25.*



bone. This latter is highly vascular, and of a bright red colour; although, when dried as a "pathological preparation," the new bony case is whitish brown, rough, and porous; the enclosed sequestrum is white, and has a smooth and firm surface, or sometimes a brown or blackish appearance, and a softened or soddened consistence, from exposure to decomposing pus-maceration.

3. *Granulations* spring from the whole inner surface of the osteoplastic cavity—the bone-ends and periosteal sheath. In consequence of progressive absorption, the *sequestrum* becomes loosened, and is somewhat reduced in size, the attached surface at length acquires a rough, or worm-eaten, and irregular appearance, and the margins become serrated or spiculated; resulting from the close adaptation of the encompassing

* Diagram from Billroth.

granulations. Hence, any uncovered part of the sequestrum is not subject to absorption, and remains *smooth*. Nature thus attempts to bring about *extrusion* of the sequestrum, as a foreign body. When removed, the sequestrum-cavity remains (Fig. 25).

The *involucrum*, or sheath of new bone, is the scene of certain *formative* changes. It *increases in thickness*, the longer the enclosed sequestrum remains as a source of osteo-plastic irritation; so that, in the course of years, the bony case might become more than half an inch thick. Losing its rough and porous character, it gets smoother and more compact or stronger, yet somewhat thinner; thus altogether more nearly resembling the natural shaft of a long bone. The *cloacæ*, having served the temporary purpose already noticed, become smaller; but whether they are ever entirely closed seems doubtful. Whether the *medullary canal* be reproduced, as after the reparation of fracture, is as yet undetermined. If, in the production of the new bone-shaft, any *muscles* lose their attachments, they regain new points of insertion, and are thus admirably enabled to resume their respective actions.

EXFOLIATION, or superficial necrosis, presents the same appearances as to the state of the dead portion of bone. But it results generally from the destruction of the periosteum; consequently, no periosteal sheath of new bone is produced. The plate of dead bone is detached—as in deep necrosis—by linear ulceration forming a groove circumferentially; but the detached portion not being ensheathed by new bone, it is thrown off from the surface or exfoliated, and exposed by open abscesses or sloughing; or it can be easily removed surgically by forceps. The periosteum of the *cranial bones*—the pericranium—even when uninjured, does not seem to have the power of forming a sheath of new bone; and thence the same result ensues—exfoliation. The dura mater is nearly equally unproductive—within the skull.

MODIFICATIONS OF NECROSIS.—(1.) In *young persons*, affected with acute periostitis, the *epiphyseal cartilages* of a long bone may undergo *ossification*, although rarely, at the upper and lower ends of the bone simultaneously; but then the sequestrum will be detached very early, before the new bony case can have completely formed. If, therefore, the sequestrum were removed at this period, the limb would be weakened, and remain weak, owing to removal of the foreign body, which, as a source of irritation, induces osteo-plastic deposit.

(2.) *Suppuration of an epiphysis* is also attended with early detachment of the sequestrum at that end; and this event may lead to such displacement and projection, by muscular action, that perhaps the bone protrudes through the integument; instances of which have occurred, with regard to the femur at the knee-joint, and the humerus, at the elbow. In such cases, destruction of the joint will probably be inevitable.

(3.) *Partial Necrosis.*—Various forms of partial necrosis sometimes occur. In the shaft of a long bone, necrosis may be limited to the *walls*, to a portion of bone *within* the wall, or to the *cancellous* structure, as a completely central necrosis. Such cases are rare.

NECROSIS WITHOUT SUPPURATION.—Necrosis is not invariably followed by suppuration. This “quiet necrosis” is apparently due to the fact that the death of the bone occurs in the course of *chronic osteitis*; the shaft of the bone gradually dying as its sources of blood-supply are cut off, partly

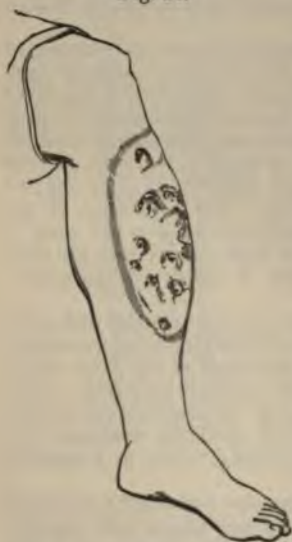
by inflammatory changes within it, and partly by the formation of bone in and beneath the periosteum and endosteum.

Diagnosis.—Necrosis unattended with suppuration may simulate a malignant disease, in the formation of a large tumour or swelling, is hard and incompressible; spontaneous fracture also sometimes takes place, and yet this event may not, for at least many weeks, be followed by suppuration.

The Signs of Necrosis are the characters of necrosed bone, as is described.

Necrosis is attended with violent and *deep-seated pain*, considerable *redness*, and *swelling* of the surrounding soft parts. Suppuration sooner or later, in consequence of inflammation of the bone—often having led to necrosis, or as the result of prolonged irritation.

Fig. 26.



sequestrum, itself a foreign body, matter discharged through the *sinus openings* is usually sanious, dark color, and fetid, although sometimes it is thick, yellow character of health especially in necrosis arising from a local cause, as compound fracture with a healthy constitution. The size of the sequestrum will be fairly determined by the boundary of the integumentary swelling, and by the spaces between the cloacæ (Fig. 26), when a probe is introduced. The *fever*, which had been of inflammation, during the period of osteitis, assumes an irritative character when bone becomes necrosed; and suppuration, with prolonged purulent discharge, is attended with hectic and exhaustion. Unlike caries, necrosis occurs more frequently in the *shaft* of the bone than in the articular ends, of long bones more often in the *compact*, than in the cancellated structure, of any bone. The difference of liability is due apparently to the lower degree of vascularity, and vitality therefore, in the compact texture. Every bone is sub-

ject to necrosis, but certain bones are more commonly affected: the *tibia*, *humerus*, *ulna*, *radius*, *clavicle*, lower jaw, upper jaw, *scapula*, and *cranium*.

In the *flat bones*, last named, necrosis usually takes the form of *exfoliation*.

Acute necrosis is met with chiefly in the form of diffuse inflammation—whether as diffuse periostitis or osteo-myelitis, rapidly terminating in the death of the bone. The long bones are most liable to be thus affected, and specially the shaft of the femur or of the tibia. It occurs frequently in children, after fever, exposure to cold, or from injury or contusion. The pain might be mistaken for that of *acute rheumatism* for the concurrent swelling around the bone, and œdema of the

cases, the whole extent of the shaft perishes, as far as the
s; but acute necrosis may pass beyond this line, and even the
y be implicated, at either end of the bone.

ral necrosis is necessarily more obscure, owing to the depth of
id condition. The symptoms resemble those of *chronic abscess* in
ance of bone. Deep-seated and, perhaps, throbbing pain, with
elling of the bone, or puffiness over a particular spot, are the more
istic symptoms, and their persistence is even more significant.

ES.—(1.) *External and traumatic* causes seem to have a more
effect in producing necrosis, unaided by any predisposing consti-
influence, than in relation to caries. 1. Any *injury* detaching
stem will probably be followed by more or less necrosis; except-
the cranial bones, or others which are highly vascular. Thus,
d and comminuted fractures of the long bones often lead to
either in the form of exfoliation or a sequestrum. Violent con-
may so damage the osseous texture and medullary membrane as
se necrosis, or sometimes, by the extravasation of blood, detach-
membrane from the cancellated bone. The irregular application
in amputation lacerates and contuses the bone-end, especially the
m, and is thus apt to be followed by necrosis, in the form of an
ring. 2. *Severe cold*, as in frost-bite, and deep *burns* are also
te causes. 3. The impaction of a *foreign body* in a bone, as
an shot wound, slowly induces necrosis. Powerful *irritants* have
d effect, even apart from any inflammatory action. Thus, the
on of a strong caustic—as the potassa fusa, or one of the mineral
an ulcer over the tibia, may kill the subjacent bone; and the
of a deep wound in the thigh, with perchloride of iron, to arrest
age, has necrosed the femur. The fumes of phosphorus, in lucifer-
panuliferous, often produce necrosis of the lower jaw; this
irritant entering the bone, apparently, through carious teeth.
form of *inflammation* of bone—osteitis, periostitis, or osteo-
—may also induce necrosis. 5. Any *disease* of bone, as cancer, is
ociated with death of the portion of osseous texture affected; and
ure of an adjoining tumour, or the extension of an abscess, may
at least exfoliation.

Constitutional causes are very influential; sometimes predis-
o, or frequently producing, necrosis. *Scrofula*, *syphilis*, and
the excessive administration of mercury, represent this class of
but necrosis occasionally results from typhoid fever, scarlet fever,
x, scurvy, and other exhausting diseases. It occurs more fre-
n *youth*, particularly as affecting the femur or humerus. In *old*
lower ends of those bones are subject to spontaneous necrosis,
the lower end of the tibia especially; the bone dying as a form
gangrene, affecting the osseous texture, and involving the joint.
angrene, senile necrosis is more acute and takes a rapid course.
ther extreme of life—infancy and childhood—necrosis occurs
a connection with caries, and in the bones of the tarsus or of the

SEQUENCES.—*Albuminuria*, and *amyloid degeneration* of the liver,
nfrequent constitutional consequences of prolonged suppuration.
accidents are liable to happen in the course of repair. Fracture

may take place; or, the new bone undergoing some alteration of shape and direction, the limb becomes *deformed* and *shortened*. The ultimate detachment of the dead portion of bone sometimes extends to a large vessel, or the point of the sequestrum may be driven into an artery in some movement of the limb; giving rise to serious *hemorrhage* externally, or to the formation of *aneurism*. The new bone may itself be attacked with necrosis; in which event, any repair will be very defective.

TREATMENT.—The removal of any cause in operation must be the primary consideration. Thus, as arising from detachment of the *periosteum*, exfoliation may sometimes be prevented by timely replacement of this vascular membrane; or if adhesion takes place between the bone and adjoining soft parts, or granulations spring up from the surface of the bone, a new periosteum will be gradually formed.

Constitutional causes suggest the medicinal treatment appropriate for scrofula, or constitutional syphilis, which proves very beneficial in most cases.

Suppuration and *abscess* must be treated on ordinary principles; while the accompanying hectic, or the constitutional irritation arising from the presence of dead bone, should be supported by a tonic and stimulant plan of treatment with nourishing diet.

SEQUESTROTOMY.—*Extraction of the Sequestrum.*—The operation consists in cutting down upon the bone, and extracting the sequestrum, by means of serrated bone-forceps. In making the *incision*, advantage is taken of the course of the fistulous tracks leading to the cloacae in the bony case; and then the latter apertures are made available for removal of the sequestrum. Sometimes, one of the cloacae is sufficiently large to allow of the extraction of the sequestrum through it. Or the cloaca may be enlarged, or two such apertures thrown into one by excising the intermediate portion of the bony case with strong cutting-pliers, straight or angular bladed. Sometimes a chisel and mallet may have to be used, the new bone being so hard that it is more easily chipped away. The *sequestrum* may perhaps be pushed upwards or downwards, so that one end can be seized with the forceps, and thus the whole be withdrawn. Or again, it may be more convenient to divide the sequestrum by the same instrument, and extract either fragment separately; or, by removing a central portion, either end-piece may be extracted. The removal of any portion of the bony case is undesirable, as the new bone is not reproduced, and the limb would remain proportionately weakened; care also must be taken not to damage the interior of the sheath. *Hæmorrhage* occurs freely during this operative procedure; the blood springing from the vascular soft parts around, or welling up from the new bone. It can generally be arrested by pressure; but in this, and other operations on bone, the Surgeon will find the advantage of Esmarch's elastic ligature around the limb, previously emptied of blood by means of the elastic roller. The bottom of the wound should be lightly dressed with antiseptic wool, or plugged to suppress hæmorrhage; any inflammation consequent on the operation must be subdued by ordinary treatment; and eventually the limb should be supported by a starched bandage until granulation is complete, and the bony case has acquired sufficient strength to bear the weight of the body or the movements of the part. The resulting appearance is that of a linear depressed cicatrix.

exfoliation may be thrown off naturally; or, when partly detached, the point of separation may be ascertained by passing a probe beneath the bone, and perhaps by a little leverage with the handle of a saw. The bone may be raised from the subjacent granulations. For this purpose one or more of the fistulous tracks will usually have to be laid open; the exfoliated portion can be readily extracted with forceps.

When the whole of the bone is necrosed, or short of its articulation, amputation may, occasionally, be had recourse to in extensive necrosis. Thus, the lower jaw has not unfrequently been removed for necrosis caused by the fumes of phosphorus. Removal of the ungual phalanx of a finger, for necrosis from whitlow, has proved perfectly successful in preserving the end of the finger.

AMPUTATION must be regarded as an extreme resource, but justifiable in some cases for the preservation of life. 1. In necrosis involving the articulations, or where the limb has become disorganized by suppuration and profuse suppuration, or the general health undermined by the disease, amputation is unavoidable. 2. As connected with compound fracture, amputation may be treated by removal of the sequestrum; but the death of the limb is so often associated with comminution, and severe damage to the soft parts, as from the direct violence of contusion, that necrosis of the bone on compound fracture more often necessitates amputation. In the more rare cases, where a main artery is opened by ulceration, and the bone is sequestered, removal of the limb will generally be necessary to ligature of the vessel, *in situ*, or of the main trunk.

Rickets or Rachitis.—This disease affects more or less the whole skeleton. The earthy matter of the bones is diminished, and the organic matter is, therefore, proportionately increased; the cancelli are enlarged and filled with a brownish-red fluid. Both the periosteal and the medullary canals appear to be more vascular than in health, and the former becomes thickened. Bones in this state have acquired great brittleness and inflexibility, thence undergoing remarkable changes of shape, in consequence of the weight of the body, or other forces to which they are

subjected. The signs of rickets are some of these peculiar deformities of the skeleton. They are found often also in connection with manifest osteomalacia. Perhaps the earliest observable deformity is a swelling of the wrist, due to enlargement of the carpal epiphyseal ends of the radius and ulna. The knee and ankles often present enlargement in like manner.

Deformities of the bones soon follow, and in the order, generally, in which they are observed, from below upwards. Under the weight of the trunk, the femora and fibula of both legs are curved outwards and forwards, the feet yielding and turning inwards; with this excurvation of the knees also are bowed outwards, accompanied perhaps with inward curvation and bending forwards of the femurs, and corresponding changes of the thighs; thus altogether presenting the rickety and distorted appearance familiar to experience. Sometimes, the opposite changes take place: incurvation of the legs and of the thighs, with a bow condition, and flat feet everted. Occasionally, the curvatures are in opposite direction in the two limbs; a general excurvation on one side, with incurvation on the other side. When the child crawls on its hands and knees, the bones of the upper extremities

ae. Bones thus affected are *soft* and *flexible*, and much *lighter* than normal; on section, the osseous texture yields a gritty sensation, the colour being reddish-brown or maroon, exhibiting the peculiar gelatinous matter in an extremely rarefied osseous texture. *Atrophy*, by the loss of the cancellous texture, and thinning of the walls of the medullary canal, is associated with the substitution of the peculiar gelatinous and cartilaginous matter. The periosteum and articular cartilage are healthy.

Mollities ossium and *Rickets* have some structural characters in common, such as the marked diminution of earthy matter, and rarefaction of the osseous texture; both diseases also affect more or less the osseous matter generally. But in the former disease, decalcification occurs *after* perfect ossification; and the gelatinous matter is peculiar to *mollities ossium*. In respect of its fatty character, the disease has some resemblance to *fatty degeneration*; while, in virtue of the nuclear and cellular elements, a few of which may be caudate-shaped, there would be some alliance to the structural elements of *Cancer*. As distinguished from *Senile atrophy* of bone, *mollities ossium* is distinguished by the loss of the osseous texture, as well as by the medullary canal filled with the peculiar gelatinous substance, and which also takes the place of the compact walls of the bone, now reduced perhaps to a thin shell. Otherwise, the thin bony case resulting from senile atrophy far resembles, and might be mistaken for, the atrophy which characterizes *mollities ossium*.

SYMPTOMS.—Wandering pains in the affected bones are common, and of a rheumatic character, but more severe and persistent. The general health accompanies these osseous pains; exhaustion and some emaciation precede any perceptible change in the bones. Then a fracture here or there, and progressive deformity, leave scarcely any doubt as to the nature of the disease. The bones evince little or no tendency to the production of callus; deformity resulting from their bending increases, the patient becomes a wretched cripple, yet living perhaps for years. Ultimately, death results from sheer exhaustion; or functional disturbance, consequent on derangements of the viscera or pressure from deformity, proves fatal. **DIAGNOSIS.**—From *Rheumatism*, it is at once diagnosed by these symptoms of morbid osseous condition; from *Cancer*, by the very distribution of the disease, affecting more or less the whole osseous system, and by the deformity. From *Rickets*, as well as other diseases, *mollities ossium* may be distinguished by the disease having occurred in young persons whose bones had become ossified and firm—at least, therefore, after the middle age. The state of the *urine* is peculiar. It contains a great abundance of earthy matter, phosphate of lime, removed from the blood and eliminated through the kidneys. But the urine may contain a peculiar substance, nearly allied to albumen, and in great quantity, the hydrated deutoxide of albumen, and 66·97 parts passing in every 1000 parts of urine. An ounce of urine passed through a filter to an ounce of blood lost, as regards its albumen. The precipitate of this hydrated deutoxide of albumen is its solubility in water, and the precipitate with nitric acid being dissolved by heat and when cold.

—*Mollities ossium* in no way arises from an imperfect formation

of the osseous texture. It would appear to be hereditary in some *Females* are more subject than males, and repeated pregnancy engender a predisposing condition. The pelvis is then affected frequently than in other women subject to *mollities ossium*.

TREATMENT.—No known medicinal agents have any curative effect. A generally tonic and nourishing plan of treatment may somewhat allay the concomitant exhaustion of *mollities ossium*, and opiates allay wearing pains. Posture and mechanical contrivances are also used in counteracting the progressive deformity, and rendering it tolerable to the patient, when bedridden.

Fragilitas Ossium.—Brittleness of the bones is, pathologically, the opposite condition to Rickets; implying a *superabundance* of matter in their composition.

Occurring as a natural change in the bones as life advances, also, at other periods, be symptomatic of cancer, syphilis, scurvy, or probably, of other diseases of, or affecting, the osseous system.

Tumours of Bone.—**Exostosis.**—Exostosis is an out-growing bone; its texture therefore resembles either the compact or the cancellated structure of bone.

The **COMPACT** variety, consisting of solid bone, is of small size, very hard—hence named **IVORY** exostosis. It is generally situated on flat bones, especially the *cranium* and in the *orbit*; on the lower maxillæ; occasionally on the scapula, ilium, or the ungual phalanx of which I have removed such an outgrowth. This variety of exostosis, observes Sir James Paget, occurs in *forms*. Some grow on the exterior of the bones of the skull, in the form of spheroidal, or lens-shaped lumps, attached, commonly, by rather broad bases. Others, which are usually of deeply lobed and nodular form, grow in the diploe, or the frontal or other sinuses, whence, as they enlarge, they project through the gradually thinned and perforated layers of bones that at first enclosed them. The former kind increase to an inch in diameter; the latter may increase to many inches, and they commonly project into the cavity of the skull, as well as externally, or into the cavities of the orbits or any other adjacent parts.

The **CANCELLOUS** or **SPONGY** variety, consisting of the open texture of bone, containing marrow, and invested with a very thin layer of compact tissue, is of considerable size, and yields somewhat to pressure. It is generally situated on the shaft of a long bone, but may also be found on the *os pubis*, on its inner surface, just above the condyle; on the *os ischii*; or the phalanges of the fingers or toes.

In both conditions, the *structure* of exostosis usually resembles that of the bone on which they severally grow. Both varieties grow beneath the perosteum or adjoining perichondrium; and however the texture may resemble that of bone, a boundary line is always present where the structure is discontinuous. *Mucous burners* are sometimes found on *apophyseal* exostoses; these sacs contain ossifying cartilage, loose or attached, and communicate with the neighbouring bone, each bone being, according to Rindfleisch, prolonged into the exostosis by a *vascular membrane*. Inflammation and suppuration of the exostosis may seriously complicate an exostosis, otherwise it is of little importance to destruction of the joint. Exostosis genera-

; but many may form, when they are usually *symmetrical*. This is particularly observed in the cancellous variety.

THIRD variety of exostosis is recognized by some pathologists. It is attached to bone, although not as an out-growth, but proceeds from the ossification of *tendons, fascia, or muscles*, and is consequent on chronic inflammation, induced perhaps by injury. Appearing in the form of spinous processes of bone, these exostoses may be found in considerable number, and connected with any one or more of the long bones, affecting chiefly their articular ends at the attachments of tendons. Associated in their nature with this anomalous kind of exostosis are certain ossific formations in the substance of muscles, and which, as arising from some muscular strain or other injury, are known as "*exercismata*." Thus, in the deltoid muscle, osseous development sometimes results from repeated pressure or contusion by the habitual use of a rifle or fowling-piece. Hence, it is occasionally met with in the shoulder of soldiers and sportsmen.

SIGNS.—The characters of exostosis are sufficiently obvious; a very hard, or a somewhat yielding, rather pedunculated tumour, immovable nearly so, and attached to the bone as an out-growth.

Both forms of exostosis are *slow-growing*, and particularly the compact variety; but the cancellous attains a far larger size. Both may undergo certain *destructive* changes; necrosis, or sloughing away from the bone, and with ulceration of the superimposed integument. Exostoses may occasion various *functional disturbances* by pressure. The situation of the tumour will very much determine these results. Thus, an ivory exostosis has projected into the orbit; or, growing from the inner table of the skull, has pressed upon the brain; or, from the pubic bone, has perforated the bladder; and cancellous exostosis, or tendinous formations, in the neighbourhood of a joint will more or less impair motion.

True exostosis is *never malignant*; and the osseous out-growth will always be distinguished from an ossifying sarcoma or cancer out-growing in bone.

CAUSES.—The *compact* variety is attributed to syphilis, scrofula, or other diseases affecting bone, and which produce an out-growing hypertrophy of the compact osseous texture. The *cancellous* variety results from the ossification of an enchondromatous or cartilaginous tumour. Both varieties commence, probably, in earliest infancy. The physeal exostosis can only occur in youth, or not later than the twentieth year. (Billroth.)

TREATMENT.—Exostoses which remain stationary, or which form in certain situations, as the orbit, or involve a joint, such as the knee, are better left alone. The danger also of exposing cancellated bone should always be considered; diffuse suppuration and pyæmia being very liable to follow the operation of removal. The tendinous formations will probably prohibit operative interference, by their number, and the disposition to ossific deposits. Otherwise, an exostosis may be removed mechanically, by *excision*; or destroyed, by nitric acid or other *caustic*, applied to its exposed base.

Compact or ivory exostosis is often very difficult of excision. *Instantaneous* section has been practised in a few cases, with a view to absorption taking place. Exostoses do not recur after removal; and,

fortunately, even when the base of attachment is left, the tumour is likely to grow again.

Enchondroma.—The *tumour* has a more or less irregular, lobed surface, and is of more or less firm, but somewhat elastic, consistence; varies also considerably in size,—being that of a pea, sometimes, growing from one of the phalanges of the fingers, or attaining to the size of a cocoa-nut or larger mass, as when seated on the head of the bone in the popliteal space. Enchondroma—or, occasionally, some other form of growth—may be contained in the *centre* of a bone, and surrounded by an osseous shell; it then feels so hard and inelastic as to resemble an exostosis; but, in a large stage of growth, the tumour seems to become softer, at least in parts, from further expansion of the shell, which now yields with a *crisp crepitation*, like that of parchment, when handled.

TREATMENT.—*Excision* or *amputation* will be appropriate, according to the size and relations of the tumour. When these conditions admit of the removal of the tumour, and, by an incision so as to examine the interior, it is found to be lodged within an expanded shell of bone, *enucleation* may be practised; the cartilaginous growth being turned out of its shell, and the cavity plugged with lint. Encouraging results have thus been obtained.

Fibrous Tumour.—The formation of a *fibrous* tumour in connection with bone is far more rare than the cartilaginous tumour. It is illustrated by fibrous epulis and fibrous nasal polypus; both of which, however, are fibrous *out-growths*. *Periosteal* fibroma—having its origin in the periosteum—invades the *osseous* texture, as well as growing outwards. The fibrous tissue, in the form of fasciculi, may have a radial arrangement from the periosteum outwards. Externally, the tumour has a *nodulated* character, and its consistence may vary in different parts, being *hard* and fibrous, or *soft* and succulent.

The **SIGNS** of any such tumour much resemble those of enchondroma, and their diagnosis is unimportant.

The **TREATMENT** is *excision* or *amputation*.

Cysts.—Two kinds of cysts have been found in bone; the **SEROUS** and **SANGUINEOUS**. They are *multilocular*, the cavities often communicating with each other, and they are met with in the jaws or in the long bones, their situation being near the articular ends. They grow to a large size, that of a cocoa-nut or even of a head. *Unilocular* cysts are also described by Nélaton as containing a gelatinous matter, of a fibrous or fibro-cartilaginous structure, occupying the whole of the cavity of the cyst. These are found in the same situations as the serous, but grow to a less size. Cysts in bone form mostly in adults.

SIGNS.—They produce an expansion of the surrounding osseous texture, and at length being enclosed in a thin lamellar capsule of bone, they yield a *crackling sensation* under pressure with the finger and a *deep* more obscure *elasticity* or *semi-fluctuation*. *Perforation* here and there taking place by progressive absorption of the lamellar capsule, the enclosed tumour becomes more clearly perceptible. The superimposed skin yields before the increasing tumour; but *without* discolouration or any participation in the disease, and there is little or no accompanying pain. The tumour is thus plainly non-malignant in its development.

TREATMENT.—*Fluid* cysts may be laid open by removing a portion

trephining or otherwise, and the cavity dressed from the lint. Granulation will then obliterate the cyst. *Solid* is excised, or recourse had to *amputation*; according to the position of the cyst.

Tumours.—In bone, as in other parts, tumours occur, cysts. FIBRO-CYSTIC tumour of bone commences, apparently, in loose tissue, and growing outwards, occasions fracture. CYSTIC is another such tumour.

These are those of cysts in bone; an *elastic sensation* or obscure swelling distinguish this tumour and other innocent cystic from Cancer. The femur was the seat of the disease in four cases; amputation was followed by permanent recovery in the above.

Cysts in bone are interesting chiefly in relation to the *fluid* cyst described. The entozoon has been, in all cases, the *echinococcus* or accephalocyst; except in one case, mentioned by Mr. Wilson, where the *Cysticercus cellulosæ* was found in the interior of one of the long bones. But hydatid cysts are very rare. These cysts may be found in flat bone, as the skull or ilium, or in the expanded head of the long bones.

Diagnosis with reference to ordinary fluid cysts can scarcely be made, the cyst increasing in size, fracture takes place, as probably the most reliable sign; and the bone remains ununited. This, however, is not true of other diseases of bone. A discharge of fluid containing pus would determine any question of diagnosis. This may occur spontaneously, or be obtained by puncture.

TREATMENT, also, is the same as for ordinary fluid cysts; but it is not possible to destroy the interior of the hydatid cyst by freely applying nitrate of silver or other caustic.

Sarcoma.—The bones are very liable to be the seat of sarcoma, and assume the typical forms of histological character; the tumour being *solid-celled*, *spindle-celled*, *giant-celled*, or *mixed-celled* sarcoma. It may originate (1) from beneath the periosteum, as a *periosteal* tumour; or (2) from within the substance of the bone, as an *intramedullary* or central tumour. Whether originating within, or on the surface, the long bones are most frequently affected, and especially the *ends*—although here the central tumour is usually met with. It is more often occurs in the lower end of the *femur*, and the *tibia* or *fibula*, adjoining the knee-joint; or the upper end of the *humerus* may be affected, forming a tumour, as of the shoulder-joint. In the lower end of the radius or the ulna is the seat of *osteosarcoma* or *osteoid sarcoma*. But the flat bones may also give rise to sarcoma; the *scapula* not unfrequently, the cranial bones more rarely. In round bones, as in the carpus and tarsus, are seldom affected. Perhaps, it may be said, that the nearer the trunk, the more liable to sarcoma is the growth; as witnessed when either the humerus, or the femur, is the seat of sarcoma.

Bones are apt to be the seat of production at either extreme of life—youth or old age; but more commonly *mid-life* seems to be the period. And both sexes appear to be about equally subject.

The *histological characters* of sarcomata affecting bone, although not differing essentially from those of the typical forms as produced in other parts, are *modified* by the special structure of osseous texture, which may be associated with the particular form of cell-growth, constituting the tumour. Diffused within the substance of bone, or springing from its surface, beneath the periosteum, neither the central nor sub-periosteal sarcomas are *encapsuled*; the one being encompassed only by a cortex of bone, expanding with the growth; the other being enclosed only by an expansion of the periosteum,—which also bounds a central sarcoma, as the osseous cortex yields with the enlarging growth of the tumour to the surface of the bone. In the course of its growth, the structural elements of the tumour are prone to undergo *degenerative changes*, possibly by fatty transformation, usually by calcification; the latter change affecting especially a sub-periosteal sarcoma, owing to the ossifying influence of the periosteum.

SIGNS.—With the alterations thus induced in the structural condition of the tumour, its *physical characters* are no less changed. The tumour, which was originally firm, or hard, more particularly in the central form of sarcoma, now becomes even harder, having the consistence of cartilage or of bone.

The **DIAGNOSIS** of sarcoma in, or on, bone may be obscured by the situation of the tumour; (1) a *central sarcoma* being denoted only by a *general enlargement* of the bone, but which may be produced also by the formation of *central cancer*, *intra-cystic growths*, or even by thickening of an hypertrophic character, as resulting from *chronic osteitis and periostitis*; or by an *abscess* in bone, with some enlargement; (2) while a *sub-periosteal sarcoma* presents a more palpable tumour, but of scarcely less indefinite character. The more or less *rapid growth*, and *infective course* of the tumour, must, however, be taken into account; in a word, the *vital history* of the growth overrules any doubt referable to the mere appearance of the tumour itself.

The only **TREATMENT** will be by operative interference for complete removal of the tumour, and at the earliest period of its growth. The operations of *excision* and *amputation* are subject to the same conditions as relating to Cancer. (1.) A *central sarcoma* admits of excision with less probability of recurrence than the periosteal form of growth; provided only that the operation be performed at a sufficiently early period. But the difficulty of diagnosing the tumour, when, thus located within a bone, it may be denoted only by some general enlargement of the bone—say, of the lower articular end of the femur—will, perhaps, rarely warrant recourse only to excision. Amputation above the next articulation—at the hip-joint, in the case supposed—is always the more secure operative procedure. (2.) *Periosteal sarcoma* would generally demand removal of the limb, and thus high above the source of disease, rather than amputation in the continuity of the shaft of the bone affected.

In some localities, any operation may not be practicable, owing to the uncertain anatomical relations of the tumour—even at an early period of growth; as sometimes in connection with the upper jaw; or sarcoma affecting the ribs or the pelvic bones.

Recurrent Osteoid Tumour is illustrated by a series of three preparations in the Museum of the Royal College of Surgeons, to the remarkable

of which Mr. Holmes has called attention. A *hard* and *heavy*, *osseous* substance formed around the ends of the femur and tibia, extending into the knee-joint, extending far up the thigh and implicating popliteal artery, vein, and nerve, so as to cause œdema and severe pain. Amputation was performed at the thigh. The patient remained for five years; then another osteoid tumour formed on the stump of femur, accompanied with severe pain. Amputation was performed *sup.* The tumour appeared to grow, not from the bone itself so as from the periosteum, and enclosed the femoral artery. An *act.* of health again continued for two years; when another tumour about the stump, progressed upwards, out of reach of operation, finally proved fatal, by inflammation and sloughing of its soft covering. Twenty-five years after the first appearance of the disease. The health of the patient, a male, remained unaffected during the period.

TREATMENT.—Recurrent tumours of bone admit only of free *excision* *operation*—as the size and relations of the mass may indicate. But as liability to recurrence will generally render the former operation inadvisable; and even amputation may prove ineffectual, the case noticed having resisted three such ablations.

CANCER.—Each species of Cancer—*encephaloid*, *scirrhus*, *colloid*, *melanotic*, *thelial* cancer—is liable to form in connection with bone; but as a *secondary* formation. Encephaloid is the most frequent. Like diseases of bone, Cancer may affect the *substance* or the *surface* of a bone. In the one situation, it is known as *interstitial* or possibly *central* cancer; in the other, as *periosteal* cancer.

In the *substance* of bone, **INTERSTITIAL** cancer occurs in the form of *small* nodules, having a whitish colour, and the consistence of *scirrhus* or *hard* encephaloid cancer. The cancer-cell—so little absolutely *characteristic* of cancer—may be indistinguishable or absent. These cells, coalescing, form a mass, which occupies the cancellous tissue, and tends into the medullary canal. The bone surrounding such a mass is expanded and thinned or thickened; with osseous fibres forming the substance of the tumour, radiating from its centre. It is most commonly in the *articular ends* of a *long* bone, or in a *flat* bone of the pelvis or skull. As affecting the whole bone, this condition of disease is sometimes designated *infiltrated* cancer of bone.

On the *surface* of bone, **PERIOSTEAL** cancer forms between the bone and the periosteum; rarely involving the one, while the other may sometimes be traced over the tumour. Osseous fibres radiate from the surface of the bone through the tumour; and a bony deposit, forming a *coral-like* mass, often spreads around it. Periosteal cancer appears, usually, in *young* bones, especially affecting their *articular ends*. The incrusting nature of the contiguous joint generally escapes, in both this and the *interstitial* formation of cancer; although the disease may extend to the *joint*.

OSTEOID cancer is a term used to designate a further degree of ossification that commonly met with in *interstitial* and *periosteal* cancer. This is analogous to the ossification of *enchondromatous* or *fibrous*, and *fibrous*, tumours. The osseous fabric or skeleton of the tumour which has undergone ossification, may thus represent an

tumour, unrestrained, grows more rapidly. The ordinary *enchephaloid* tumour become apparent: its *soft consistence*, *bluish colour*, and *large size*; with purple discolouration of the *arteries* and *ramifying veins*, and pain throughout the course of the *disease*, of a thrilling or blowing character, may become perceived to enlargement of the vessels in the tumour, as it undergoes. Fracture often occurs at the affected part. *Glandular* constitutional symptoms will confirm the diagnosis.

(2.) *Periosteal* cancer presents a *tumour* of more *clear* character, and it grows more rapidly, at an earlier period. attached to the bone often become extensively infiltrated with

DIAGNOSIS.—Thus may Cancer in, or on, bone be distinguished from any other species of tumour—except Sarcoma. In regard to all other tumours, the *vital history* of the growth is into consideration. The probability will be in favour of cancer when the tumour commenced *before puberty* or *after mid-life*; when an *enchondromatous* or a *bony* tumour on a finger or toe, or on a bone, or when the tumour has *grown rapidly*, to perhaps double its size in six months, and is not inflamed. When a tumour has existed on a bone for a period of two years or longer, without showing signs of malignancy, it is probably not cancerous or recurrent.

A tumour on the shaft of any bone but a phalanx, is rare, and so are any, except cartilaginous out-growths, on the pelvis, except the hard bony tumours, on the skull. (Paget.)

The diagnosis of malignant and non-malignant tumour is, however, principally between *enchephaloid* cancer and *enchondroma*, the presence or absence, ultimately, of the signs which indicate extension of the disease to the *integument* and neighbouring *glands*, will mainly determine the question. Puncture with a needle is also available as a critical method of examination, no less than in other doubtful forms of tumour. *Pulsation* may be distinguished from *anæmia* by the *expansive* base

the next joint; and in *periosteal* cancer the line will be most loudly selected even higher up, above the origin of the muscles, rated probably by proximity to the disease. In considering the duty of amputation, with a view to the prolongation of life, the able evidence as to the existence of internal cancer should always be taken into account—bone-cancer being always a *secondary* growth.

Pulsating Tumour of Bone, and Osteo-aneurism.—**STRUCTURAL VARIATIONS.**—A pulsating tumour in, or on, bone may be—(1) a tumour, *itself* pulsating, but in connection with an artery which communicates its pulsations thereto; as an enchondromatous, fibrous, or other tumour, thus connected; (2) a *vascular* tumour; usually cancerous and, especially, encephaloid in the course of its development; (3) a vascular tumour or erectile tumour of bone, resembling aneurism by anastomosis of the soft parts, and constituting *osteo-aneurism*. This last condition is very rare, if it exist at all.

The situation of such tumour is generally the *cancellous interior* of a bone, especially of the long bones, at their articular ends; as the femur, humerus, radius; also in the flat bones, as those of the pelvis and scapula, and in the ribs.

SIGNS AND DIAGNOSIS.—(2) and (3.) An enlargement of the bone, with a *thrilling pulsation* and *bruit*, are symptoms common alike to *any* highly vascular tumour, cancerous or erectile. And this pulsation *subsides* on compressing the main artery of the limb. But the *incompressibility* of the enlargement would be distinctive of a mass having formed independent of the blood-vessels, a vascular tumour, and not a vascular growth or a congeries of vessels. The bony case which encloses any such tumour renders this test inapplicable, until the bone yields and the mass protrudes on the surface of the bone. Or compression of a main artery would be impracticable, owing to the situation of the tumour, as in the case of the long bones. Or again, the supply of blood may come from so many collateral branches, that it cannot be arrested by compression. (1.) A tumour, growing from bone, and pulsating *in connection with an artery*, is distinguished from a vascular tumour, in like manner,—the former being *incompressible*, and remaining when the supply of blood to the main trunk is cut off, although the pulsation ceases. Between *osteo-aneurism* and ordinary aneurism the diagnosis would be made, by the *thrilling character* of the pulsations, instead of a uniform expansion; and if the absence of the latter be attributed to the probable contraction of the supposed true aneurism, then the tumour—like any solid unconnected tumour—could be *lifted off the bone*. In some cases also, where no artery runs of probably sufficient size to form an aneurism, the question as to its existence can hardly be suggested.

When a pulsating tumour of bone—whether cancerous or erectile—has *protruded* from the interior of a bone, the distinctive characters of its form of growth become more apparent. Thus, an erectile growth of *osteo-aneurism* may be made to subside sufficiently, perhaps, for the surgeon to feel the *bony rim* of the gap through which the protruded tumour has come.

Subsequently the nature of the tumour will be still further declared by its *more developed characters*; encephaloid cancer, for example, grows rapidly, and involves the skin and lymphatic glands.

TREATMENT.—Having due regard to the almost exclusive cancerous nature of pulsating tumour of bone, caesarean must have the same restricted applicability as with regard to cancer of bone in general. This operation has failed in cases of orbital and scapular pulsating tumours.

Amputation is the only justifiable operation of removal, in other than the few exceptional cases alluded to. The more decidedly encephaloid the disease, the more appropriate will be this more sweeping operation. It should be performed as soon as the nature of the disease is declared, and the line of amputation be chosen above the joint nearest to the bone affected.

Ligature of the main artery leading to the part is said to have proved successful in some cases; but probably not in pulsating tumour of bone having an encephaloid character. Compression might be tried previous to ligature.

JOINTS.

CHAPTER XXX.

INJURIES.—SPRAINS.—WOUNDS.—DISLOCATIONS.

Sprains or Strains of the Ligaments of Joints.—These lesions represent a stretching or partial rupture of the ligamentous tissue; and thus essentially resemble similar injury of TENDONS (Chap. XVIII.), which, with their sheaths, are usually involved in the spraining injury. The ankle or wrist joint is most commonly affected. Severe pain, possibly inducing syncope, is soon followed by swelling around the joint, or even by synovitis; succeeded by stiffness, and continued inability to use the joint. A very severe sprain, or its repetition, may leave the joint in a state of permanent weakness, and liability to dislocation. Or disease of the joint may ensue, in persons predisposed by any constitutional condition, as a rheumatic or gouty diathesis.

The CAUSE of sprain is a violent and sudden twist or wrench of a joint, whereby the opposing ligaments are stretched or somewhat ruptured. Even the epiphyses of bone may thus be detached, in a young subject.

The TREATMENT consists in an easy position and rest; warm or cold applications, according to the inflammatory character of the swelling and the feelings of the patient; followed by stimulating embrocations, and the support of a bandage, strapping with broad strips of plaster, or a starched bandage.

Wounds of Joints.—A wound extending into a joint may, like other Wounds, be incised, contused, or lacerated; and the joint, accordingly, is more or less opened, or extensively injured. But the admission of air into the joint chiefly determines the importance of any such lesion.

The extent of the synovial membrane or the size of the joint should also be taken into account.

SIGNS AND SYMPTOMS.—The escape of *synovia* from the external aperture, or an *exposure* of the *interior* of the articulation, are the only pathognomonic or absolute signs of a wound into a joint. Synovial fluid is recognized by its translucent, viscid, albuminous character, resembling raw white of egg; the interior of a joint presents the additional characters of glistening synovial membrane and cartilage, and the peculiar disposition of the articular surfaces. But these appearances should be discovered by inspection, or gentle introduction of the finger; an exploring instrument might penetrate the synovial membrane, and cause a wound not otherwise existing. Wound of an *adjoining bursa* would be attended with the discharge of a similar fluid, but examination of the interior will determine the diagnosis.

Inflammation of the synovial capsule rapidly supervenes, presenting the usual appearance of *synovitis*, but distinguished by two peculiarities; the *intense* pain, and *more acute* constitutional disturbance. *Suppuration* also is almost inevitable, with hectic, and irreparable destruction of the articular surfaces constituting the joint; or *pyæmia* intervening at an early period, proves fatal.

TREATMENT.—(1.) *Preservation* of the limb—without any operative interference—should be attempted, in the first instance. But the probability of success will depend chiefly on the nature of the wound, and the extent of the synovial membrane or the size of the joint. 1. A *small incised* wound or *puncture*, in a *small joint*, as one of the finger-joints, allows or conservative treatment with great probability of success; a lacerated, and perhaps contused wound, of a large joint, as the knee, is almost surely fatal. 2. Among *large joints*, however, those of the upper extremity—the shoulder, elbow, and wrist—are, commonly, more favourably disposed than in the lower extremity—the hip, knee, and ankle. To save a joint, the synovial capsule must be thoroughly *cleansed* of blood-clot, grit, or other foreign matter,—as a source of septic poisoning, or simply of irritation; and this having been effected by *antiseptic injection*, the wound should be at once *closed*, accurately, with strapping of isinglass plaster, to solicit primary union; and if a drainage-tube be inserted, the opening is to be placed dependent. *Antiseptic dressing* is then to be applied. *Sutures* may be inserted, to bring the lips of a joint-wound accurately together before applying the dressing, but they should be entered only skin deep, not through the synovial membrane; and as matter is more apt to form, under the irritation of sutures, thus preventing primary union, and may perhaps find its way into the joint, I seldom have recourse to them for the closure of a small wound. Metallic wire is, however, less obnoxious than silk suture. Catgut will scarcely remain undissolved for a few days, until primary union has taken place. An *ice-bag*, over the dressing, will aid in repressing inflammation. But the limb must be kept in a state of absolute *rest* by means of a splint, and in such *position*, therefore, as shall be most conducive to relaxation and ease.

(2.) *Synovitis* having proceeded to *suppuration*—the synovial capsule having become converted into an abscess, the joint should be laid freely open by *incision*; and a *position* of the limb secured favourable for its

utility, in the event of irreparable destruction of the articulation, followed by ankylosis.

(3.) *Destruction of the joint* without this issue must be met either by *excision* of the diseased bone, or by *amputation* of the limb. The choice of these alternatives should be determined by a due consideration of the local and constitutional conditions. Fortunately, *traumatic arthritis*, as proceeding from the synovial membrane to the adjoining cartilages and bones, seldom engages these structures beyond the range of excision. But the *constitutional exhaustion* may be so severe, as to compel recourse to amputation, rather than peril life by the slow recovery consequent on excision. Or, amputation may become necessary—and then without an alternative—*after excision*.

Primary amputation, as a rule, should not be resorted to. But, in its preventive relation to *pyæmia*, or *tetanus*, this operation may be justifiable occasionally. A lacerated, and perhaps *contused*, wound of a large joint, as the knee, represent conditions which demand immediate amputation.

Fracture involving the joint, or *dislocation*, as complications, in similar cases of wound, mostly necessitate immediate amputation.

Wounds of Particular Joints are to be regarded in accordance with the general pathology and treatment of this kind of injury.

DISLOCATION.

Dislocation is a displacement of the articular portion of a bone from the surface on which it was naturally received; accompanied by more or less laceration of the ligaments, of the tendons and muscles, or other surrounding structures, and with some effusion of blood around the seat of injury.

As arising from external violence, Dislocations may be termed *traumatic*; and when consequent on destruction of the joint from disease, they are named *spontaneous* or *pathological*—dislocations which take place chiefly in the hip and knee joints. Dislocations differ essentially in regard to the mode of their reparation, according as they are unaccompanied or attended by an open wound communicating with the dislocation; the one being termed SIMPLE, the other COMPOUND. COMPLICATED Dislocation is also a recognized distinction, signifying the concurrent injury of some other part. CONGENITAL Dislocation arises from malformation of the joint affected.

In respect to the extent of displacement; dislocation may be *incomplete*, as hinge-joint dislocations not unfrequently are; or *complete*, as those of orbicular joints usually are; this difference being due to the particular shape of the articular surfaces. The primary displacement is made more complete, especially in orbicular-joint dislocations, by tonic contraction of the muscles subsequently.

Signs.—Dislocation is attended with (1) a corresponding defacement or deformity of the *outline of the joint*; as represented by dislocation of the shoulder-joint, downwards into the axilla. The natural prominence of bone near the articulation either disappear, or are less conspicuous, as the great trochanter at the hip-joint; or they may be more prominent, as the

acromion, in dislocations of the shoulder. (2) The *length of the limb* is altered, and especially if the dislocation be complete. Elongation, or shortening, is produced; according as the head of the displaced bone happens to be lodged below, or above, the level of the articular surface on which it naturally moves. The possibility of either, or of only the latter, alteration of length taking place is determined by the form of the articulation. An orbicular joint allows of dislocation in any direction from its circumference; upwards, downwards, forwards, backwards. Hinge joints cannot allow of displacement in more than three directions; backwards, forwards, and laterally, to the right or left. (3) The *direction* of the dislocated bone, and thence of the limb below, is characteristic. Certain muscles being thrown out of action, by displacement of the portion of bone to which they are attached; others, thus acquiring a mechanical advantage, preponderate. The natural balance of opposing muscles, as flexors and extensors, is lost, and the limb acquires that particular attitude to which the predominant muscles direct it. To these positive signs may be added two negative ones: (4) *immobility* of the limb, which gradually supervenes, in proportion to the tonic contraction of the muscles; and also (5) the *absence of crepitation*. A false crepitation can sometimes be felt, owing to friction of the articular head of the bone on the torn ligaments and tendons; unlike the rough attrition of the bone-ends in fracture. The extravasation of blood gives rise to the appearance of ecchymosis or bruise, as the blood becomes subcutaneous; but this may not take place for some days after the dislocation. Bruising will, of course, be more immediate and conspicuous where dislocation is produced by direct violence to the part, as by a fall on the shoulder. In examining a dislocation, the limb should be compared with its fellow; at least, in any doubtful case. *Pain* and *inability* to use the limb are *functional* symptoms of Dislocation, but of equivocal value in aid of determining the nature of the injury.

Dislocation is attended with more or less *shock*, followed by reaction; or the latter is sometimes accompanied with exhaustion, this mixed state constituting *traumatic delirium* or prostration with excitement; which may be succeeded by *tetanus*. But, in general, no such serious consequences need be apprehended; after the dislocation has been reduced, the immediate shock of the previous injury soon passes off.

CAUSES OF DISLOCATION.—1. Dislocation is produced, in general, by *external force*, suddenly applied. 2. *Predisposing* causes are, however, very influential. Some such causes are functional actions depending on *anatomical conditions*; as the shape of the articular surfaces allowing a free range of motion, laxity of the ligaments retaining them, and the powerful action of many muscles on a long lever-like bone. All these predisposing conditions are combined in the shoulder-joint, and less so in the hip. Hinge joints, being more favourably circumstanced anatomically, are less liable to dislocation. Other predisposing conditions are acquired by *disease*; and these also have reference to the cartilage and head of the bone, which may be destroyed by ulceration and caries; to the ligaments, as loosened by this process; or to those muscles which naturally aid in retaining the articular surfaces in apposition, but which may have become wasted and enfeebled, or paralyzed.

REPARATION.—The ruptured ligaments, and tendons, if any be torn,

... without inflammation. ... through the ... reparative material, and ... are absorbed; and thus the ... is ultimately restored to nearly its ... The presupposes the previous reduction

... its natural articulatory surface or ... the formation of which will be ... association. ... are precisely analogous to those

... of the displaced head of ... This implies a ... the antagonistic ... the head of bone in its new ... and counter-extension of ... parallel to its natural ... Coaptation is

... the reparative process of the ... a suitable ... muscular con- ... of displacement ... supplies the ... rest. ... essentially, ... exposing ... The struc- ... is the same as in ... are repaired with ... This ... which is also ... Word.

... of simple flexion. ... irregular ... of simple

... the ankle-joint. ... and ... and dislocations

... generally speaking ... in the ... through ... from ... in the ... which ... of the injury from ... to the bone at

some distance off, and the injury is more a *laceration*, and less extensive; in the other case, the force is applied *directly* to the joint, and the injury is more a *contusion*. In both cases, the lacerated or contused textures are damaged beyond the apparent extent of injury; and the *shock* to the nervous system is more severe than with simple dislocation, owing to the greater damage to the soft parts, including nerves.

Tetanus is, perhaps, more likely to ensue than after a contused or lacerated wound alone, and especially if the compound dislocation be that of a ginglymoid joint, as of the thumb. Injuries of unyielding fibrous or ligamentous textures are generally prone to induce Tetanus.

The textures injured, being in a state of disintegration, die at least to some extent around, if the wound be allowed to remain open. This purely *traumatic gangrene* is the same as that caused by a lacerated or contused wound. *Limited*, therefore, to the part injured, and defined, eventually, by a line of demarcation between the living and dead textures, the gangrene is also *immediate*, if the injury itself be severe.

COURSE AND TERMINATIONS.—*Inflammation* supervenes, followed by suppuration, often profuse, and partial sloughing; or gangrene, possibly, on a larger scale. Yet this also is *limited* to the seat of injury. Ultimately, compound dislocation, when reduced, not unfrequently undergoes reparation; the torn ligaments and tendons becoming reconnected, and the wound closing up by the healing process of suppurative granulation and cicatrization.

Spreading gangrene—due to some morbid condition of the blood—is only contingent, occasionally, on compound dislocation; just as it may be associated with compound fracture, and with contused and lacerated wounds. The phenomena of this species of gangrene were described under the last-named form of Injury.

The Prognosis of Compound Dislocation, as gathered from the foregoing elements of its natural course and tendency, is far less favourable than that of simple Dislocation. An *open* wound, communicating with the joint, as compared with subcutaneous laceration of the soft parts, is one unfavourable ground of prognostic distinction. Scarcely less so is the *greater extent* of their laceration, usually, in compound Dislocation, especially if produced by direct violence. *Spreading gangrene* is an adventitious condition, but as implying the co-operation of a constitutional causes, it has a most unfavourable significance.

TREATMENT.—The same rules of treatment are applicable as for simple dislocation.

Reduction of the displacement may present special difficulties. Thus, if the bone *protrude*, excision is preferable to violent efforts at reduction. In regard to the ankle, and elbow joints, removal of the ends of bone may be resorted to, with advantage and safety. The head of the astragalus has been removed, when, by dislocation forwards, it protruded and could not be returned.

The Wound.—Reduction having been accomplished, and the limb retained in a suitable position—to prevent the recurrence of dislocation—by appropriate bandaging or apparatus, the treatment peculiar to *compound dislocation* is that relating to the wound, and state of the soft parts involved. The *primary* indication is to *close the wound*, with the view of soliciting its union by adhesion, and thus convert the dislocation into a

simple one. For this purpose, a pad of dry lint, overlaid with *tænax* lint soaked in carbolic-acid solution, should be applied over and at the wound, so as entirely to exclude the air. I much prefer a dry to wet application, which becoming heated by the part, may act as a pot in promoting suppuration. The carbolic-gauze dressing might, however be employed, instead of *tænax*, as a more potent antiseptic. But, when the process of the case, when primary adhesion becomes obviously possible, the attempt to close the wound entirely should be forthwith discontinued, and a *drainage-tube* inserted, in order to give free vent to the matter during the process of suppuration.

With *progressive suppuration*, the diffused accumulation of pus should be met, by early, free, and dependent *incisions*, as in compound fracture, for the discharge of matter as it forms, and to relieve tension, or to prevent burrowing around the joint. A *drainage-tube* is then introduced. The dry dressing may be exchanged for a poultice, or the more elastic epithem of spongio-piline soaked in warm water, as a fomentation, with a suitable application; to be followed by light water-dressing, carbolic acid solution, or boracic ointment, when the continuance of warmth and moisture would only sodden and relax, and when the wound is beginning to granulate. The same *hygienic* and *medical* treatment also, as for compound fracture, will prove beneficial, in sustaining the system under the influence of fever and exhaustion consequent on prolonged and perchance profuse suppurative discharge, and in overcoming the *typhoidal fever* induced by gangrene or sloughing.

AMPUTATION.—The “question of amputation” depends upon the supervention of *gangrene*, or of *profuse suppuration*. (1.) *Primary amputation*, only when the *whole substance* of a limb being involved by compound dislocation, the limb itself is already, in the first instance, virtually lost, and life as inevitably endangered. (2.) *Secondary amputation*, when the extent of damage done by the injury being itself *partial*, the supervention of gangrene or of profuse suppuration is only proportionately probable, and the limb, therefore, not inevitably lost, nor the life perilled. Postponement of amputation is justifiable to give the limb its chance of preservation by delay; while the preservation of life is provided for by *timely* amputation, when the adverse circumstances, alluded to, actually supervene.

The rules laid down in surgical works, with reference to the extent of injury, are not the expressions of a sufficiently accumulated experience in different doubtful cases; and they overlook the necessarily unknown capabilities of reparation in different individuals, with the beneficial influence of antiseptic dressings.

Excision, indeed, bids fair to surpass amputation in some compound dislocations.

Complicated Dislocations.—(1.) Dislocation may be complicated by association with the laceration of *muscles* which are put upon great stretch; as the pectineus and adductor brevis, by dislocation of the tibia downwards into the thyroid foramen; even their unyielding *tendons* sometimes ruptured, as the sub-scapularis tendon, by dislocation into the axilla. *Large blood-vessels* occasionally share the same fate, accompanied with hæmorrhage and livid swelling; a *main nerve* also may be torn asunder. *Fracture* of the shaft, or of the head of the bone dislocated

another complication. This is more likely to occur in dislocation from direct violence; as by a fall on the hip or shoulder, the neck of either bone is perilled; the olecranon also may be knocked off; the bulky head of the tibia shattered; or the tarsal end of the tibia broken and bruised. Thus, then, all the parts *around* a dislocation are liable to be involved in the injury. But, obviously, none of those special injuries to internal organs can occur, which may complicate the Fracture of certain bones—the pelvic bones, the ribs, the bones forming the skull. (2.) *Morbid conditions* of the joints themselves may predispose to dislocation, and thence to its recurrence, by previous disorganization of the joint affected. So also, the diseased condition of the joint is frequently a local manifestation of some *blood-disease*—e.g. syphilis or scrofula, as a constitutional cause, rather than of traumatic or local origin.

TREATMENT.—Firstly. If any *morbid condition* be in operation, locally or constitutionally, predisposing to the occurrence of Dislocation, the treatment must be entirely *subject* to such *causative* condition. Secondly. If there be any *injury additional* to Dislocation, the treatment of the *dislocation* may be of entirely subordinate importance, even although it be, as in many such cases, severely Compound. Complications of this kind may necessitate immediate amputation.

Unreduced Dislocation and False-joint.—The alterations of structure consequent on unreduced Dislocation are the *formation* of a *new joint*, the *obliteration* of the former or *natural articulation*, and of the *track* through which the head of the dislocated bone passed to its present locality.

(1.) The new *joint* is more or less perfectly constructed. If the displaced bone be lodged upon *muscle*, it gradually burrows for itself a convenient nest, the two surfaces become mutually adapted to each other, and a capsular ligament being formed of condensed cellular tissue, an imperfect joint is established. (2.) But should the bone have found a resting-place on *bone*, this, by absorption, loses its periosteum, and that its articular cartilage; a receptacle is excavated suitable to the impression of the displaced articular surface; a bony rim or lip is thrown up by the periosteum around the margin of this newly formed cavity; the surrounding cellular texture, moreover, becomes condensed into a capsular ligament, which further provides against any displacement; and thus a far more perfect joint is constructed.

A porcelainous deposit takes the place of cartilage, on the *head* or *surface* of the dislocated bone; or instead of this *eburnation*, an imperfect *fibro-serous* surface or synovial capsule may be formed. The *natural articular cavity*—whence the bone was dislodged—loses its cartilaginous investment, and closes in. It is, at length, partially obliterated by a dense fibrous deposit. So also is the *track* in the textures, through which the bone had passed.

The **DIAGNOSTIC SIGNS** of unreduced Dislocation, and of the construction of a new joint, are—the physical signs of dislocation, *coupled* with restoration, more or less entirely, of the functional use of the limb or part. The characteristic alterations in the form of the joint, length of the limb, and direction of its axis, still remain; while the power of using it is regained, and proportionately as the new articulation is perfectly finished off. Hence, this restoration of function is, at length, far more

ges; the condyles slipping forwards in front of these cartilages, on sides, or on either side alone. Bilateral dislocation occurs in about every three cases. Partial dislocation happens comparatively

less.—Certain obvious and characteristic signs attend dislocation of the jaw. The mouth is open, and cannot be closed, the jaw being drawn forward by the action of the genio-hyoid muscles, aided by the hyoglossi, the digastric, stylo-hyoid muscles; and the lower teeth project in front of the line of the upper teeth. In addition and speech are interrupted, the lips moving when the person attempts to speak, the saliva dribbling over the chin. The cheeks are sunken and flattened, and the direction of the jaw directed somewhat backward towards the ear. The process of the temporal bone on either side, with a marked prominence of the coronoid process, below the malar

FIG. 27.



a depression can be felt in front of the external auditory meatus, depending to the natural situation of the condyle, and an oblong fulness in the temporal fossa, with fulness of the masseter muscle. Bilateral dislocation on one side only is denoted by the same signs; but in a lesser degree, and one-sided, the jaw being twisted somewhat to the opposite side, though this alteration may be scarcely appreciable. Thus, the open mouth, and projecting lower jaw, has a singularly wry appearance. The prominence of the coronoid process, with fulness, instead of sunkenness of the cheek, on the side of displacement, are also conspicuous; a depression can always be felt in the proper situation of the condyle, but not on the other side.

Partial dislocation presents similar signs, but they are still less permanent, and perhaps recurring, the condyle slipping to and fro.

CAUSES.—Muscular action would seem to be the usual cause, in the opening of the mouth widely; as in laughing, gaping, violent declamation, yawning, vomiting, convulsion, or an attempt to take too large a

The condyles moving forward on the transverse root of the zygomatic arch, are dislocated by the action of the external pterygoid muscles and anterior portion of the masseters, the genio-hyoid and other muscles then depressing the jaw. Consequently, the temporal, internal pterygoid, and masseter muscles are placed on the stretch, or even strained. External violence is an occasional cause, as in tooth-extraction, or the introduction of something into the mouth. Age would certainly tend to have some predisposing influence; complete dislocation occurring rarely in infancy or advanced life, owing probably to peculiarities in the form of the jaw at these periods.

TREATMENT.—Reduction is readily accomplished by retracing the dis-

placement. The Surgeon, standing in front of his patient, introduces his thumbs—protected by a cloth—into the mouth, and applies them to the lower molar teeth on either side; depressing the angles of the jaw, the chin is raised by the fingers externally at the same time, and the jaw is jerked in or returns with a snap. Chloroform may be administered, when reduction cannot be accomplished without its aid. Dislocation on one side is reduced in like manner; and so also partial dislocation, which may, however, be returned by the natural efforts to open and shut the mouth, the patient being told at the same time to make a lateral motion, or to bring the jaw forward. A four-tailed bandage must then be applied, as in fracture of the lower jaw; and the patient fed on liquid food for some days, during reparation of the ligaments.

Dislocations of the Spine—through the inter-vertebral substance—are almost necessarily accompanied with fracture of the articular processes, or of the bodies of the vertebrae; excepting in the cervical region, the articular processes there being placed more obliquely than those of the other vertebrae. Any dislocation of the spine is rare, and more so without fracture. The displacement may be forwards, and more commonly in this direction; lateral rotation, to either side; or backward displacement. It is always incomplete, except perhaps in the cervical vertebrae, which may possibly undergo complete displacement, forwards. (Malgaigne.) The seat of dislocation varies; this injury occurring in the cervical region most frequently, and particularly at the fifth or sixth vertebrae; in the dorsal region occasionally, and particularly at the eleventh or twelfth vertebrae; in the lumbar region very rarely, but perhaps at the first or second vertebra in this portion of the column. In all dislocations of the spine, the cord is more or less involved. Detachment of the inter-vertebral substance, with displacement of the bodies of the vertebrae, is a very uncommon form of injury.

The Signs and Symptoms of spinal dislocations are similar to those of fractures in this region; some irregularity or projection at the seat of dislocation, and paralysis, more or less complete, of those portions of the body which receive the nervous supply from below the point at which the dislocation has occurred.

The Diagnosis, as compared with fracture, can hardly be determined by symptoms, which may be absent in fracture, and present in all the dislocations accompanied with fracture; but a peculiar rigidity of the spine in the position assumed by dislocation, the trunk inclining immovably forwards, and rarely, or more commonly to one side, will generally be diagnostic.

Dislocations of the spine are, obviously, of a serious or fatal character; and are therefore—since so, the higher in the spinal column dislocation takes place.

Prognosis. The same as in fracture; falls on the head, feet, or back, and violent flexion of the spine backwards, or to either side.

Treatment.—Reduction of the displacement is impossible, or would be injurious, and but little can be done beyond the general treatment for fracture of the spine.

Dislocations of the first two cervical vertebrae are conveniently referred to the head bone. The atlas may be dislocated from the occipital bone, the displacement being incomplete. Dislocation of the atlas from the axis—by axial displacement—has been known to occur forwards or

ards, or as a lateral rotation of one articular process forwards. The joints which keep the odontoid process in place may or may not be injured. *Fracture* of the odontoid process at its base may have occurred. The obvious importance of these lesions, accompanying dislocation, is the relation to the falling backwards of the odontoid process on to the *cord*; complete compression causing instant death.

Dislocations of the Ribs have been met with, occasionally, at either *vertebral* or *sternal* articulations. In the former situation, the *head* of the rib is sometimes dislocated, and always *forwards*; generally one of the lower ribs, including the false or floating, has been thus displaced. Injury is usually associated with *fracture* of the transverse or spinous process of the corresponding vertebra, or with fracture of another rib.

The **SIGNS** of this dislocation will be obscure; the *depression* and *swelling* of the rib, adjoining the spine, might indicate fracture, and in some cases the distinctive *crepitus* may be absent, owing to displacement, imperceptible, through the depth of the fragments. Either injury also may arise from a fall or blow on the back.

The **TREATMENT**, however, is the same in both cases. It will be impossible to replace the head of bone, but rest of the part should be secured by a roller rib-bandage, to fix the chest until any inflammatory action has subsided.

In the *sternal* articulations, the rib-cartilages are liable to displace forwards, in advance of the sternum, presenting one or more *projections* at the seat of the articulations. This displacement may be accompanied with fracture of the sternum. But, generally, it is the slow action of some habitual muscular action throwing back the shoulders, as the use of dumb-bells "to open the chest," or of an occupation where, by using the arms, the ribs are pressed forwards, as in the act of kneading dough.

Reduction may be accomplished by pressing the cartilaginous process back into place, aided by the patient making a full inspiration at the time, or by bending the trunk backwards. A compress and rib-bandage are then applied.

Dislocations of the Clavicle.—(1.) THE STERNAL END OF THE CLAVICLE may be dislocated in three directions: *forwards*, in front of the sternum; *backwards*, behind the sternum; and *upwards*, or upwards and backwards, above the sternum. In these dislocations, the ligaments are more or less completely torn, according to the direction and extent of the displacement; but the bone carries with it the clavicular portion of the sterno-mastoid muscle.

SIGNS.—Dislocation *forwards* is denoted by a deformity, consisting of the *sternal end* of the clavicle in *front* of the sternum, which disappears on drawing the shoulders backwards and returns when such force is resisted; the distance between the acromion and middle line is diminished; the head is drawn forwards and turned from the dislocation, in order to relax the sterno-mastoid muscle; and there is inability to raise the upper arm. Dislocation *backwards* is denoted by the opposite appearance to the former one, a *depression* in the situation of the *sternal end* of the clavicle; but there may be dyspnoea, dysphagia, obstructed circulation, pain, from pressure on the trachea, œsophagus, vessels and nerves, &c. *Dislocation upwards* is of rare occurrence. This form of

dislocation presents a *projection above the sternum*, or even as high up as upon the front of the thyroid cartilage—the sternal end of the clavicle having been thrown upwards, with a *marked sulcus* below the inner third of the clavicle; and there is also a corresponding *depression of the shoulder*.

CAUSES.—A fall on the shoulder, anteriorly, or throwing the shoulder backwards, may cause the dislocation forwards; compression of the shoulders, laterally, or a direct blow on the sternal end of the clavicle, may drive this portion of the bone backwards; and a fall on the shoulder externally, or a blow upon the top of the shoulder, may start the bone upwards upon the supra-sternal notch.

TREATMENT.—Reduction of these three dislocations is accomplished by directing the shoulder so as to retrace the particular displacement. *Forward* dislocation of the sternal end of the clavicle may be overcome by drawing the shoulder backwards and outwards; in *backward* dislocation, similar traction of the shoulder, to even a greater extent, will be sufficient; while *upward* dislocation may be reduced by outward traction of the shoulder, at the same time raising the outer and depressing the sternal end of the clavicle. Pressure directly on the displaced end of bone, when accessible, as in the first and last named dislocations, has comparatively little effect in aiding reduction. Traction of the shoulder is best effected by using the knee as a fulcrum in the back, while an assistant places his feet as a fulcrum in the axilla; the shoulders are then bent backwards, and the elbow brought down to the side, simultaneously.

To retain the bone in position, a pad over the sternal end may have some effect in dislocation *forwards*, but a figure-of-eight bandage applied upon the shoulders will more effectually prevent the recurrence of displacement in either of the three directions of dislocation, the arm being drawn back and fixed to the side. Some permanent displacement and deformity are almost inevitable; the patient, however, recovering a good use of the arm. Even when reduction has not been accomplished or maintained, almost the same good result has ensued.

Upward dislocation occurred in one instance of dislocation backwards by direct violence—a blow with a pick-axe. (Hamilton.)

THE **STERNAL END OF THE CLAVICLE** may be dislocated—*upwards*, upon the upper surface of the acromion; or *downwards*, under the acromion, or under the coracoid process—very rarely. The acromio-clavicular ligaments are torn in the dislocation upwards; and also the coraco-clavicular and coraco-acromial ligaments in dislocation downwards.

Upward dislocation is easily recognized by the *projection of the point of the scapula* end of the clavicle, and which is more easily felt on raising the point of the scapula up to the acromio-clavicular articulation. *Downward* dislocation and fullness of the shoulder will also be perceptible. *Downward* dislocation is recognized, and distinguished, by the opposite *marked depression*, in particular, corresponding to the usual position of the sternal end of the clavicle. Downward dislocation, under the coracoid process, is more particularly characterized by a corresponding *depression of the acromion and coracoid process*, and a rapid inclination *backward and outwards* of the line of the clavicle, its outer end being

(Hamilton.) A fall on the shoulder would seem to be the usual occasion

these dislocations; the force being applied upon the top or back of shoulder, in upward dislocation; and upon the clavicle, to produce extension downwards.

TREATMENT.—Reduction is easily accomplished by drawing the shoulders backwards and outwards, the Surgeon placing his knee between them. A pad in the axilla, and the application of a bandage, as for a fractured clavicle, constitute the most effectual retentive apparatus. Great compression is available only in dislocation upwards. Many weeks should be allowed to elapse before this treatment is discontinued. Some rigidity almost always remains, but with little loss of power in the movements of the arm.

DISLOCATION OF BOTH ENDS OF THE CLAVICLE has been known to occur, but it must be placed among the rarities of Dislocations.

Dislocation of the Scapula.—The lower angle of the scapula sometimes projects, apparently having slipped from under the edge of the *musculus dorsi* muscle, which there crosses the scapula. Liston attributed displacement to the arm being "suddenly raised above the head to an unusual extent," or it may be due to paralysis of the *serratus magnus* muscle. The vertebral border of the shoulder-blade projects to a great extent, and its inferior angle is so loosely connected to the chest, that the ribs may be pushed up between the ribs and the bone half-way to the axillary cavity.

TREATMENT.—The treatment should consist in rubbing and shampooing and in the use of the interrupted current. One may give a more favorable opinion of the result if, on passing the current down the course of the nerve of Bell from the root of the neck to the costal attachments of the muscle, the scapula is braced up into its proper position. Bandaging the chest is futile; and if the surgical mechanician is intrusted with the treatment of the case, he will probably supply an ingeniously constructed splint, whose expense is only equalled by its uselessness.

Dislocations of the Shoulder-Joint.—These are the commonest of all Dislocations. The head of the humerus may undergo displacement downwards, into the axilla, **SUBGLENOID**; forwards, **SUBCORACOID** and **CLAVICULAR**; backwards, on the dorsum of the scapula beneath its spine, **POSTERIOR**. These dislocations occur, probably, in the same order of relative frequency; the first named being by far the most common; the second, occasional; and the third, very rare.

PARTIAL dislocation is said to occur; either as the *subcoracoid*, or a dislocation upwards—*supra-glenoid*—under the acromion. But the latter dislocation is complete, the head of the humerus being lodged entirely out of the glenoid cavity; the upward dislocation is incomplete, the head of the bone lying partly in the glenoid cavity.

1.) DISLOCATION DOWNWARDS, OR SUBGLENOID;—the head of the humerus is lodged in the axilla, just below the glenoid cavity, and resting on the inferior costa of the scapula, between the subscapular muscle and the head of the triceps. The capsular ligament is torn to a considerable extent, and generally the tendon of the subscapular muscle, near its insertion into the small tuberosity. The muscles attached to the great tuberosity are stretched or torn, particularly the *supra-spinatus*; and, possibly, the tuberosity itself may be detached. The axillary vessels and nerves suffer compression by the head of the bone.

(2) *Dislocation Posterior, or SUBCLAVICULAR*;—the head of the humerus is under the pectoral muscles, on the inner side of the coracoclavicular space, and below the clavicle, and resting on the second and third ribs. The acromion may be completely separated from the neck of the bone; lower epinotus muscle must not, namely, subscapularis detached from under clavicle, infra-spinatus and teres minor from the scapula; and possibly, the prominence of humerus may itself be away from the head of the humerus. The axillary vessels and nerves are compressed.

(3) *Dislocation Anterior, or SCAPULAR*; the head of the humerus is detached from glenoid cavity on the dorsum of the scapula, infra-spinatus, will separate the infra-spinatus and teres minor muscles.

FIG. 25.



capsule is ruptured, and the muscles in front of the joint are stretched; namely, the subscapularis, supra-spinatus, and long head of biceps.

Signs.—Certain signs are common to all three dislocations of shoulder. These signs are—flattening of the shoulder, external depression below the acromion, owing to the absence of the head of bone, and a corresponding projection of the acromion above (if the presence of the head of the bone in an abnormal situation, down forwards, or backwards; some immobility, and inability to use it and pain, particularly when the arm is moved. But the direction of the humerus or arm, and the length of the arm, with the

The head of the bone, are distinctive in each form of dislocation; by determining its DIAGNOSIS.

(1.) Dislocation *downwards* into the axilla is accompanied with some *extension* of the arm *outwards*, in a line with the trunk, and neither *backwards* nor *forwards*; an *elongation* of the arm is observable, or can be ascertained by measurement,—taking the apex of the acromion as a point above the joint, and the external condyle of the humerus as a point below it. The head of the humerus can be felt in the axilla.

(2.) Dislocation *forwards*, or subclavicular, is distinguished by a *flexion* of the arm *backwards*, and somewhat *outwards*; with some *enlargement*. The head of the bone can be felt under the *clavicle*.

(3.) Dislocation *backwards*, or subspinous, is characterized by a *flexion* of the arm *forwards*, and somewhat *outwards*, or occasionally it is *drawn* by the side; with some *shortening*. The head of the bone can be felt under the *spine* of the scapula.

Partial dislocation *upwards* is characterized, principally, by the position of the head of the bone, which appears to be drawn higher up in the glenoid cavity, and unnaturally prominent in front; abduction produces *crepitus*, the humerus rubbing under the acromion, and the arm being *locked* as the arm is raised; and severe *pain* is experienced by contraction of the biceps muscle.

The DIAGNOSIS of shoulder-joint dislocation, as compared with *fracture* of the neck of the humerus, may be determined by the presence of signs common to all these dislocations, and the absence of true fracture. *Atrophy* of the deltoid muscle, resulting from contusion or injury, simulates dislocation only by the flattening of the shoulder, and the overhanging acromion.

CAUSES.—*Direct* violence, as a fall on the shoulder, in the direction of the arm, leads to the particular form of dislocation. *Indirect* violence applied to the arm, when itself in a position favourable to the particular form of dislocation. Thus, forcible abduction of the arm may occasion dislocation *forwards*. Violent contraction of the deltoid, in lifting a heavy weight, may also tilt the head of the bone downwards, out of the glenoid cavity.

Dislocation *forwards*—subclavicular—may result as the completion of coracoid displacement, which is then regarded as a *partial* dislocation *forwards*. Or, the subclavicular dislocation may, it is said, be converted into dislocation downwards.

TREATMENT.—Reduction may be effected in various ways:—

(1.) By *direct* extension and counter-extension. The patient being seated in a chair, a sheet or jack-towel is drawn under the axilla on the affected side, around the chest over the opposite shoulder, and attached to a fixed, resisting object, or held by assistants. Extension is made of the arm, by means of a linen band fastened by a clove-hitch knot. The arm should be drawn out at a *right angle* to the chest, and extension maintained, by an assistant, or by pulleys, when necessary. The operator placing his *knee* in the axilla, and depressing the shoulder with his hand, while he *slightly inclines* the arm *downwards* with the other hand, the head of the bone passes into the glenoid cavity with a jerk or snap, indicating the reduction. Extension is discontinued, and the arm brought to the side should be secured by a few turns of a roller around

axilla, and drawing the arm well downwards, makes the foot as a fulcrum. For many years I have adopted the readiest, simplest, and most effectual.

(4.) By *raising the arm*.—The patient lying recumbent sitting behind the shoulder and fixing it with one hand up *perpendicularly*; then bringing it *down suddenly* the head of the bone may snap into place.

(5.) Dislocation *backwards* may sometimes be reduced by bending the arm *backwards*, and at the same time drawing *upper end* of the *humerus* with the other hand.

(6.) Reduction by *manipulation*. This method is said to nearly all dislocations of the shoulder-joint, but it was specially eligible in dislocation *downwards* into the axilla. First, in flexing the forearm upon the arm, and at the same time the elbow is lifted from the body; secondly, in rotating the forearm upwards and outwards, using the forearm as a lever; thirdly, in this last movement by rotating the humerus downwards while at the same moment the elbow is brought down again. In dislocation *forwards*, this method of attempted reduction inevitably increase the displacement,—rotation of the humerus outwards would have the effect of driving the head further outwards.

Shoulder dislocations of the humerus are to be reduced by either of these methods; generally, by direct extension, or extension, under the influence of chloroform; aided, perhaps, by making extension, which should be slowly maintained.

COMPOUND DISLOCATION OF THE SHOULDER-JOINT is a rare accident.—The question of *amputation* must be decided by reference to the considerations which render the sacrifice of the joint in **COMPOUND DISLOCATION**, generally; and principally to the axillary vessels and nerves.

Dislocations of the Elbow.—This joint is liable to dislocation; some of which relate to both bones.

muscles are relaxed, the triceps posteriorly, and all the muscles from either condyle of the humerus, excepting the supinator. The median nerve is pressed forwards by the humerus; the ulnar nerve is, sometimes, painfully stretched over the projecting end of the ulna backwards.

DISLOCATION OF THE RADIUS AND ULNA OUTWARDS, or to the outer side, is far less frequent than the foregoing, and usually incomplete. The radius still articulates with the humerus, but the great sigmoid cavity is displaced outwards from the trochlea, so that its *central crest* rests upon the olecranon, which separates the *capitellum* from the *trochlea*. If the olecranon remains unbroken, the *radius* is displaced in the same direction to the same extent, its head resting against and directly over the *outer condyle*. More complete dislocation may occur, and commotion rarely; the head of the radius being, perhaps, thrown backwards.

The direction of this dislocation is outwards and upwards or backwards; the olecranon process of the ulna lying above and behind the outer

side. In forward dislocations, the ligaments are more or less completely ruptured. In the ordinary forms of such dislocations, the brachialis and anconeus are the only muscles much disturbed, the biceps traversing the articulation a little more obliquely; while the arteries and nerves do not suffer much, if at all.

DISLOCATION OF THE RADIUS AND ULNA INWARDS, or to the ulnar side, is more rare than dislocation outwards, and always incomplete. The olecranon is driven over the elevated inner ridge of the trochlea, and falls upon the *inner condyle*, or *epi-trochlea*, embracing it instead of the olecranon. While the head of the *radius*, passing inwards also, occupies the

direction of this dislocation is inwards and upwards or backwards; the olecranon process of the ulna being thrust upwards above the inner side, and the head of the radius occupying the olecranon fossa.

The ligaments and muscles suffer some injury, and the ulnar nerve is liable to contusion between the olecranon and inner condyle.

DISLOCATION OF THE RADIUS AND ULNA FORWARDS, was considered without a fracture of the olecranon, this opinion having been held by Sir A. Cooper and Vidal (De Cassis); but Monin, Prior, and Denucé have each reported one example—five in

all. **DISLOCATION OF THE ULNA ALONE, BACKWARDS**, seldom happens without the dislocation of the head of the radius; yet it is possible that the olecranon process may pass backwards into the *olecranon fossa*. (A.

DISLOCATION OF THE HEAD OF THE RADIUS ALONE, BACKWARDS.—This is of rare occurrence. The head of the *radius* is behind the *inner condyle* of the *humerus*, and rather to the outer side. The ligament is ruptured. Incomplete dislocation, as occasionally seen in children, may not be attended with rupture of the annular

DISLOCATION OF THE HEAD OF THE RADIUS ALONE, FORWARDS, is more common than backward dislocation. The head of the

... Certain characters are common to all dislocations.
 (1.) Dislocation of the radius and ulna of the elbow *posteriorly*—corresponding to the olecranon in particular; with the humerus in *front* of the elbow (Fig. 2) of the forearm, with *semi-flexion* at a right angle occasionally, and *semi-pr*

Fig. 2



of flexion and extension, pronation and supination can generally be produced.
 (2.) Dislocation of the radius and ulna on the olecranon process *externally*—the head of the radius *externally*,—the inner condyle of the humerus is distinguished by the olecranon process of the olecranon, and prominent.
 The olecranon is shortened 1-2 in.

6.) Dislocation of the *ulna* alone, *backwards*, would probably be recognized by *projection* of the *olecranon*, the head of the radius being felt to be in its place; by the inclination of the *forearm* to the *ulnar side*, *partial flexion*, and *complete pronation*. If accompanied with *fracture* of the coronoid process, there will be considerable mobility, the *elbow* readily disappearing and recurring, with *crepitus*.

7.) Dislocation of the head of the *radius* alone, *backwards*, is characterized by *projection* of the *head* of the bone *behind* the outer condyle, where it is felt to rotate. (7.) Dislocation *forwards* is distinguished by a *projection* of the *head* of the bone in *front* of the humerus. In *both* dislocations the *forearm* is *shortened* slightly on its *outer side*, and inclines to *that side* with slight *flexion*, and *pronation* (Fig. 30). But the latter form of dislocation is distinguished by the position of the *head* of the radius, and the impossibility of *flexing* the *forearm* beyond a *right angle*, the *head* of the bone impinging on the *head* of the humerus brings this motion *directly* to a *dead lock*.

8.) Dislocation of the head of the radius *outwards*, may be recognized chiefly by *projection* of the *head* on the *outer side* of the *ulnar condyle*, immediately under the skin, it can be felt to rotate.

CAUSES.—*Indirect violence* is, probably, commonly the cause of all these dislocations. Thus, a fall on the hand may drive the bones backwards; possibly, outwards or inwards; the ulna alone backwards; or the radius alone backwards or forwards. But the position of the forearm, with regard to pronation and supination, will also affect the direction of dislocation. The former position facilitates dislocation of the radius forwards; and an effort to supinate the forearm, while it is

fixed and held firmly in a state of pronation, will occasion dislocation of the radius backwards. Twisting or wrenching of the forearm, as by a *lever*, may also occasion dislocation of both bones outwards or inwards; and less probably of either bone—the radius, in particular—outwards or forwards. The latter dislocation of this bone has been observed in children, by lifting the child suddenly from the floor by the arm or an attempt to sustain the child when about to fall.

Direct violence may also be the cause of most forms of elbow-joint dislocation. Thus, both bones may be thrown backwards, by a blow on the back and lower part of the humerus; or on the front and upper part of the forearm; or the bones are usually thrown outwards or inwards, by a blow on the side of the arm or forearm opposite to the direction of dislocation; and, in like manner, the radius alone has been started outwards, by a blow upon the front and upper part of that bone; or inwards, by a blow upon the back of the head of the radius.

Dislocation of the radius and ulna *forwards* is too rare an accident to be included in any general statement. In Velpeau's case, the man was

FIG. 30.



A low chair or stool, the Surgeon, resting the knee in the bend of the dislocated joint against the knee against the inner side of the humerus, and drawing or bending the bones readily come forward over into position. The immediate mobility can be bent upon the arm, even to a guarantee of reduction.

Another method.—The Surgeon grasps both hands, and draws it *forwards*; not perhaps, to steady the arm. It may be *forwards*, so as to relax the triceps muscle.

(2) Dislocations of the radius alone extend gradually from the wrist, the pressure on the head of the bone forwards to a dislocation. In backward dislocation also just throwing the head of the bone forward of the humerus; while, in forward dislocation, similarly jerk the head into place. But the head lies on the brink of reduction, and being continued.

After reduction has been effected, it is application of a right-angled splint upon the with a compress over the head of the bone; and the forearm supported in a sling.

the ulna, may be treated in the same way; position must be continued for some weeks.

CONJUNCT DISLOCATIONS of the ELBOW:
 various; best on account of their nature, &
 being caused by considerable violence.

1.) Dislocation BACKWARDS is characterized by an unnatural prominence of bone—the head of the ulna—at the posterior and inner part of the wrist, with loss of the motions of pronation and supination. In connection with fracture of the lower end of the radius, this dislocation is very uncommon; alone, it seldom occurs.

The Cause would seem to be, usually, *violent pronation*. Thus, it records the case of a laundress who, in wringing a wet sheet, effected dislocation of the head of the ulna backwards. But a fall on the hand, doubling the wrist forwards, was the occasion of this displacement in the case which came under my observation. The act of lifting by the hand gave rise to it, in a case which Duges mentions, and accident happened in both wrists, at different times.

Treatment.—Reduction can be readily effected by *forcible supination* of the forearm, with pressure on the head of the ulna forwards. Generally the bone remains in place without further assistance; or it may be tried to apply a compress and splint.

2.) Dislocation FORWARDS is denoted by a projection of the head of the ulna at the anterior and inner part of the wrist; the natural motions of this portion of the bone at the back of the wrist having been lost. The motions of pronation and supination are lost. This dislocation is even more rare than the former.

The Cause is apparently, with hardly any exception, *violent supination* of the forearm.

Treatment.—Reduction is easily effected by *forcible pronation* of the forearm, with pressure on the head of the ulna backwards. Redislocation cannot be apprehended.

Dislocation of the Radio-carpal Articulation, or Wrist-joint.

This articulation may be dislocated backwards, or forwards, but rarely.

1.) Dislocation of the hand and carpus, BACKWARDS, presents a projection—the head of the ulna—at the back of the wrist (Fig. 31), and another—the lower end of the radius and ulna

the palmar aspect; with *flexure* and immobility of the hand.

2.) Dislocation of the hand and carpus, FORWARDS, presents just the opposite appearances: a projection of the carpus in front of the wrist, the radius and ulna on the dorsal aspect, with *extension* and immobility of the hand.

CAUSES.—A fall on the hand is the usual occasion of dislocation; the back of the hand, probably, receiving the force of the shock in backward dislocation of the carpus, and the palm of the hand receiving the force in forward dislocation.

TREATMENT.—Reduction can generally be effected, in either form of dislocation, by extension and counter-extension; at the same time drawing the hand in the contrary direction to which it is inclined,—backwards in the flexed position of backward dislocation, forwards in the extended position of forward dislocation; and in either case aiding this leverage by

FIG. 31.



radius and ulna move with it. Dislocation with fracture of the margin of the articulating surface of the radius, is known as fracture." Some difficulty may be experienced in keeping the bone

(2.) *Fracture of the lower end of the radius* may be mistaken for dislocation of the wrist; but it can be distinguished in like manner.

(3.) *Fracture with separation of the fragments* is unattended with the usual fracture signs, mobility and crepitus; but it may be distinguished from dislocation, chiefly, by the resistance offered to reduction.

(4.) *Sprain*, also, simulates dislocation: here, however, the swelling is single, and not well defined, like the bony projections of dislocation; it does not appear immediately, and gradually increases.

COMPOUND DISLOCATION OF THE WRIST.—This accident is of rare occurrence. As associated with fracture, the injury may happen frequently. Always a serious injury, compound dislocation is even more so in consideration of the violence which causes it.

Treatment.—The amount of damage done to the soft textures of the bones will guide the Surgeon respecting the probability of saving the hand, or the necessity for excision or amputation.

Dislocations of the Carpal Bones, among themselves.—Dislocations, or rather subluxations, of the carpal bones take place occasionally; but, perhaps, only in one direction—*Backwards*. The bones liable to dislocation are the semilunar, cuneiform, and pisiform of the first row, and the *os magnum* of the second row, which is frequently displaced, while, according to South, the unciform is liable to displacement. All the bones of one row may be displaced, the second row overlapping the first row, backwards; as in a *Manoeuvre* verified by dissection. Dislocation of any of the bones may occur, in connection with gunshot injury, or other extensive fracture of the neighbouring bones.

The *Signs* will be—a *bony projection* at the back of the wrist, and a *loss of power*.

The *Treatment* is to reduce the bone to its place on the back of the hand, which

either *backwards* or *forwards* on the trapezium; the former displacement occurring more frequently. Either may be partial or complete. Other metacarpal bones are very seldom dislocated. *All* the metacarpal bones, except that of the thumb, had undergone dislocation, in a very unique case which Hamilton examined five years after the event, by gunshot injury.

THE SIGNS, in any case, are sufficiently obvious: projection of the end, or of the metacarpal bone, in the direction of displacement, and immobility. The direction of the thumb may be quite straight, or with flexion there is some inclination of the metacarpal bone inwards towards the palm.

CAUSES.—A fall on the thumb, bending it on itself, represents the ordinary mode of its dislocation. A blow upon the extremity and palmar surface of the last phalanx may, however, cause dislocation; the force acting in the opposite direction, or from within outwards.

TREATMENT.—Extension, with pressure on the end of the bone, will usually succeed in effecting *reduction*. A splint should then be applied, perhaps a compress to prevent any risk of redislocation. The bulky swelling of the metacarpal bone of the *thumb* sometimes obstinately resists reduction; in which case the dislocation should be left to acquire the comparative motion of a new joint, rather than the Surgeon run any risk of dividing the nerves and blood-vessels, by dividing the muscles or ligaments.

Dislocations of the First Phalangeal Bones—*at their Metacarpal-Phalangeal Articulations*.—These dislocations, also, seldom happen; usually the bone is driven *backwards*, though sometimes *forwards*. We have seen the phalangeal bones of the index and middle fingers partly driven back, in the left hand of a prize-fighter. The first phalangeal bone of the *thumb* is most frequently dislocated, and either *backwards* or *forwards*; the former displacement occurring more commonly.

THE SIGNS are characteristic: a *projection of the posterior extremity* of the phalangeal bone, in the direction of displacement, and immobility. The *thumb* presents somewhat peculiar appearances. Its first phalangeal bone, having slid backwards upon the metacarpal bone, stands off from the bone at an angle; thus allowing the *head* of the metacarpal bone to project prominently *towards* the *palm* of the hand; while the second or middle phalangeal bone is flexed upon the first, and forms another angle with the thumb. The phalangeal bone is locked in its new position, and reduction may be proportionately difficult. This immediately arises from the constriction of the neck of the bone between the lateral ligaments, as Hey believed; or between the two heads of the short flexor muscles, as affirmed by Malgaigne, Vidal (De Cassis), and others. Sir Cooper attributed the difficulty of reduction to the resistance offered by all the six muscles which are inserted into the two phalangeal bones of the thumb, the flexors more especially maintaining the displacement; that the sesamoid bones oppose reduction; lastly, the difficulty may arise from the interposition of the anterior ligament, torn from its attachments and folded in between the joint, as alleged by Pailloux, Lawrie, and many others. Displacement of the long flexor tendon inwards or outwards, so as to impede reduction, has been found by Lisfranc, Deville, and Wadsworth.

TREATMENT.—*Reduction* can sometimes be accomplished easily; by extension, inclining the finger towards the *palm*, with pressure on the

displaced end of bone. Or, the thumb may require more traction; and by first bending the dislocated phalanx backwards to increase the displacement, the articular end of the phalanx directed forwards towards the articular surface of the metacarpal, thus aiding the reduction. Extension may then be accomplished by means of a strong tape fastened on the phalanx with a clove-hitch, care being taken to protect the skin by a piece of moist wash-wrapped round the part. A more effectual mode of extension, locally, is by means of a large door-key; which, I believe, Mr. originally suggested. Passing the ring of the key over the thumb hitching it against the projecting end of bone, extension and pressure thus be brought to bear with advantage and simultaneously. The extension-instrument enables the Surgeon to apply flexion or extension, also, in any direction. Before applying any extending force, reduction may be facilitated by soaking the thumb for some time in warm water in order to relax the parts as much as possible.

Subcutaneous section of the opposing ligaments or tendons should be resorted to as the last resource.

Dislocations of the Middle and Ungual Phalangeal occur even less frequently than dislocations of the first row. pathology, signs, and treatment are similar.

CONJOINED Dislocations of the Bones of the Hand.—Those of the thumb are most common, as they are also the most serious and important with regard to the future use of the hand. But any such dislocation is usually connected with fracture, and extensive laceration of the parts.

The causes of these injuries are always some occasion of violence. The explosion of a flask of powder in the hand happened to me, driving one or more of the bones backward, and often shattering the hand.

TREATMENT.—Reduction can usually be effected without difficulty, the obstacles of ligaments or tendons having already given way of the injury. The wound should then be closed, and the joint fixed in ordinary compound dislocations. Generally, however, the extensive injury requires some operative interference. Excision of splintered portions of bone, or amputation of one or more fingers, may then become unavoidable alternatives. The preservation of the thumb, perhaps of the little finger with it, is always a consideration of paramount importance. This maimed hand will serve the useful purpose of a support to the other, by the conjunction of the thumb and finger.

Dislocations of the Pelvis.—(1.) The SYMPHYSEAL JOINT is a SYNOCHIAL ARTICULATION, and, generally, undergoes separation as a result. In one case, I found all three articulations completely separated in a young man, whose pelvis had been subjected to severe compression. The signs of any pelvic disarticulation are sufficiently obvious, and mobility at the seat of injury.

The cause of disarticulation is always some extreme violence, usually a compressing force.

PROGNOSIS.—The same as in fracture of the pelvis.

(2.) The CLAVICLE is more frequently bent or displaced than fractured, and dislocation may be forward, as the result of a fall; or back, as the result of a pressure by the head of the child during parturition.

TREATMENT.—The same as for fracture of the coccyx, or the coccygeal portion of the sacrum.

Dislocations of the Hip-joint.—This joint is subject to *four* principal dislocations, and to *five* anomalous dislocations; resulting from the freedom of the motion of the hip—as a ball-and-socket joint—in all directions. Taking the four principal dislocations of the hip in their order of liability, they are as follow:—

(1) Dislocation upwards and backwards on the *dorsum ilii*; (2) upwards and backwards on the *great ischiatic notch*; (3) downwards and forwards into the *obturator foramen*; and (4) upwards and forwards upon the *pubes*. To these may be added, as anomalous and occasional dislocations—(5) Dislocation *directly upwards*, between the anterior superior and inferior spinous processes of the ilium, or thereabouts; *downwards and backwards*, upon the posterior part of the body of the ischium, between its tuberosity and its spine; (7) downwards and backwards, into the lesser or *lower ischiatic notch*; (8) directly or vertically downwards, beneath the lower border of the *acetabulum*, between it and the tuberosity—*subcotyloid*; (9) and forwards, into the *perineum*, upon the ramus of the ischium and pubis, or upon the body of the pubes.

DISLOCATIONS UPWARDS AND BACKWARDS (1) ON THE DORSUM ILII, AND (2) INTO THE GREAT ISCHIATIC NOTCH.—(1.) The *head of the femur* rests on the *Dorsum Ilii*, or within the fibres of the deeper gluteal muscles; and it is directed backwards, the great trochanter forwards. The capsular ligament, and especially its posterior half, is lacerated, and the round ligament ruptured; the small external rotator muscles are stretched or rent completely asunder, and the *glutæus maximus, medius, and minimus* torn up more or less in extent from the *dorsum ilii*; thus allowing the head of the femur to occupy its unnatural situation. The *triceps adductor* is put upon the stretch. The particular direction of the *head backwards* and *trochanter forwards* has been attributed to the strong anterior portion of the capsule which proceeds to the anterior intertrochanteric line still remaining entire, and thus resisting the action of the rotator muscles. Resistance to reduction in this, and other dislocations of the hip, has been ascribed either to the rent capsular ligament entangling the head and neck of the bone; or to opposing muscles; or to both this ligament and the muscles.

(2.) Dislocation into the GREAT ISCHIATIC NOTCH corresponds so nearly in its pathology with that on the *dorsum ilii*, as to require only a *differential* description. The *head of the femur* lies in the *Great Sciatic Notch*, behind and a little above the *acetabulum*; being situated between the upper margin of the notch above, and the *sacro-sciatic ligaments* below. It rests upon the *pyriformis* muscle; or upon the *gemelli* and *sacro-sciatic nerve*. The *attitude of the bone*, and rupture of the ligaments and muscles are very similar to the condition of dorsal dislocation. With reference to the tendon of the *obturator internus*, the head of the femur passes downwards and backwards, and then being carried upwards, it is arrested by the tendon, or passes behind it. Hence Bigelow names this dislocation “dorsal below the tendon.” Ischiatic dislocation is sometimes secondary to that on the *dorsum*; but more frequently the former, by secondary displacement, is converted into the latter.

MECHANISM OF HIP-JOINT DISLOCATION.—The production of the dif-

the tension or relaxation of the psoas and iliacus muscles. The most valuable sign, observes never being absent, nor is it with in any other injury of the hip, whether dislocation, fracture.

DIAGNOSIS of these dislocations is, generally, clear. The position of the neck of the femur, with inversion of the limb, is very rare; and when it occurs, the head of the bone is in the sum ilii, with mobility and the fragments, will, usually, be the diagnosis. 2. *Impacted* dislocation, however, with consequently the two latter signs, is an equivocal condition. The limb can be brought down to its proper position by any moderate and just motion, to unlock the impacted head; and the diagnosis must be the situation of the head of the femur in relation to the acetabulum.

The "test line" affords an accurate indication of any dislocation, the great trochanter having

It is a line drawn from the superior spinous process of the ilium to the most prominent aspect of the ischium (Fig. 34).

In relation to the right line of the limb, this test line, in either forward dislocation or the trochanter above the ilium an inch higher.

The "ilio-trochanteric angle" is formed by a line drawn from the anterior superior iliac spine to the ilium

of the great trochanter of the femur—corresponding with the

FIG. 33.



FIG. 34.



first portion of Nélaton's test-line; a vertical line, drawn from the spinous process downwards, over the iliac bone to the horizontal plane of the body; and a third, or basic line, between the two, forming a right angle with the vertical line. The base is the "test-line." Any shortening of this (base) line, as compared with the length of the same line on the opposite side, will indicate dislocation of the femur backwards, and upwards. Shortening of the neck of the femur—from fracture or from disease, will have the same effect in diminishing the relative length of this line.

But in the application of both these test-lines, the attitude of the limb—by abduction or adduction—will obviously alter the indication, as in shortening of the limb having taken place. To make the observation correct, the limb must be placed straight in a line with the pelvis. Giraud-Teulon has devised a line of measurement which is unaffected by the attitude of the limb. Taking the middle of Nélaton's line as a point about opposite the centre of the acetabulum, a line drawn from that point to the inner condyle of the femur, may be compared with the length of the same line in the opposite thigh. Shortening of this femoral line will indicate dislocation upwards, or a diminished length of the femur.

3. *Disease* of the hip-joint resembles dislocation upwards and backwards, in its general characters; and particularly when advanced to the stage of shortening the limb. The antecedent history of limping lameness and pain, before any such resemblance becomes established, will sufficiently decide the diagnosis. Failing to recognize the nature of the case, instances have occurred of attempted reduction in hip-joint disease; a sad mistake, and which would sorely aggravate the disease.

CAUSES.—The attitude of the limb at the time of dislocation is always most influential in this, as in other such injuries. When the body is bent forward on the thigh or the thigh on the abdomen, and the thigh in a state of adduction close to the opposite thigh; * hip-dislocation upwards and backwards may then result from a fall on the foot or knee, and especially while the individual is carrying a load on the back; or from the fall of a heavy weight, as a mass of earth, upon the back of the pelvis, the body being much bent forwards. Dislocation may thus take place either on the dorsum ilii, or into the great sciatic notch; but, to gain the latter situation, the limb must be in a position more nearly at a right angle with the trunk. Age has a remarkable relation to the frequency of hip-joint dislocation. Any such dislocation is comparatively rare in infancy and advanced life; but it has been known to occur in an infant, six months old, as the earliest time, and at eighty-five years of age, as the latest time. The period of life during which dislocations of the hip occur more commonly, has been stated, by Maligne, as from twenty to forty-five years. Males are more liable than females to dislocation of the hip; owing to the more oblique direction of the neck in relation to the shaft of the femur, and also to the accidents, in the various occupations of the former sex, which cause dislocation.

TREATMENT.—*Reduction* can be effected in either of two ways: by extension and counter-extension of the limb, pulleys being necessary to overcome the muscular resistance and its duration, in most cases; or by flexing the limb on the thigh, and guiding it so into position, that the

* The state of abduction may be the only causative position in all dislocations of the thigh. See *Med.-Chir. Trans.*, vol. ix. (H. Morris.)

themselves, probably, complete the reduction—constituting the by “manipulation.”

LOCATION ON THE DORSUM ILIUM.—(1.) *Extension and Counter-extension*.—Chloroform should always be administered—unless specially indicated—to relax the muscles. A warm bath may be substituted for the relaxing influence of chloroform, in exceptional cases. The patient is placed on his back, inclining to the side opposite to that of dislocation, and raised from the ground on a bed or table, that the long axis of the thigh may be in a line with the force of extension, resisted by extension, which should be applied in the following manner. A belt is fastened round the lower part of the thigh, having a double end attached to it, terminating in a ring; to the latter a multiplying pulleys, of three cords, is hooked, whereby extension is brought into action; the distal pulley being hooked to a ring or staple driven into the wall or some firmly fixed object, in a line with the thigh. A *perineal band*, for counter-extension, must be secured in like manner.

The cord of the pulleys may be intrusted to an assistant, the latter taking charge of the thigh and hip. Extension should be made gradually increased, and steadily maintained. The *great trochanter* is observed to *descend*, and to come more into position, as extension is made; the upper part of the thigh should then be raised with one hand, by means of a towel passed under the thigh, in order to *lift* the head of the femur over the prominent brim of the acetabulum; while, at the same time, the *thigh is rotated outwards* with the other hand, thus to draw the head of the bone downwards and forwards; it will, generally, slip in with a jerk, rather than a snap, the muscles being worn out and the power of any sudden contraction. On relaxing the extension, the perceptible disappearance of the signs of dislocation, in the form of the *limb*, etc., announces the certainty of reduction. The limb is then retained in position, to guard against the liability of redislocation.

A long splint and bandage, as for fracture of the thigh, has been recommended for this purpose; but simply connecting the reduced limb to the sound limb, by means of a few turns of a bandage around the side by side, I have always found to afford a sufficient security. The patient must remain in bed for ten days or a fortnight, during the healing of the ligamentous and other tissues.

REDUCTION INTO THE GREAT ISCHIATIC NOTCH is reduced in like manner, though with greater difficulty, owing to the imbedded position of the head of the femur. *Extension* should be made *across* the *middle of the opposite side* and the *head of the bone more lifted* out of its bed; the patient is drawn more to the opposite or sound side. To effectually raise the head of the bone, it is sometimes recommended that a towel, passed under the thigh, should be looped round the neck of an assistant, who, stooping over the patient and pressing downwards with both hands, raises his shoulders, thus bringing considerable power to bear in drawing the bone forwards into its socket.

REDUCTION BY *rectangular flexion*, with *vertical extension*—*Bigelow's* method—is guided solely by the state of the ilio-femoral ligament. The thigh must be flexed to a right angle with the trunk, thus to relax this ligament; then the dislocation can be readily reduced by making extension directly upwards. Manual extension may suffice, or the pulleys can

be applied, by means of a tripod placed over the limb, to the apex of which they are hooked. In either way, counter-extension is maintained by fixing the pelvis to the floor with a belt. Sometimes, there being only a slit in the capsule, which resists the return of the head of the femur into the acetabulum, it will be necessary to circumduct the limb, in order to tear the capsule open, before reduction can be effected.

(2.) *Manipulation*.—This method of reduction was known to Hippocrates, and is now generally practised.

Dr. Reid's method consists:—"In flexing the leg upon the thigh, carrying the thigh over the sound one, upwards over the pelvis as high as the umbilicus, and then abducting and rotating it outwards."

Hamilton's description of the proceeding is this:—"The patient being laid on his back upon a mattress, the Surgeon—assuming that it is a dislocation on the *dorsum ilii*—should seize the foot with one hand and the other he should place under the knee; then, flexing the leg upon the thigh, the knee is to be carefully lifted toward the face of the patient until it meets with some resistance; it must then be moved outwards and slightly rotated in the same direction until resistance is again encountered, when it must be gradually brought downwards again to the bed. We do not know that the whole process could be expressed in simpler or more intelligible terms, than to say that the limb should follow constantly its own inclination."

In attempting the reduction of dislocation into the *ischiatric notch*, by manipulation, the same author warns us of the special danger, "that the head of the bone will be thrown across into the foramen thyroideum."

COMPLICATIONS.—1. As complicated with *fracture of the margin of the acetabulum*, dislocation of the femur backwards not unfrequently occurs. It happens more often from direct dislocation into the sciatic notch. The *diagnosis* may be doubtful; but the comparatively *easy reduction*, and the facility with which the *displacement returns* when the limb is left to itself, will generally indicate the nature of the injury. Sometimes *crepitus* may be felt, on rotating the femur, with the other hand placed upon the trochanter. This sign might, however, suggest the existence of fracture in the neck of the femur; but the *inverted* attitude of the limb in backward dislocation, as coupled with shortening, is distinctive—and the *head* of the bone is on the *dorsum ilii*. Fracture in the *neck* or head of the femur may also *co-exist* with backward dislocation. Here again, the signs are similar to those of the acetabular fracture-complication of backward dislocation. There is some mobility and crepitus, even more perceptible than in acetabular fracture, and the recurrence of displacement will be observed, when, after extension, the limb is left to itself; but the limb may be inverted or *everted*, as well as shortened, and the *head* of the femur lies on the *dorsum ilii*.

2. *Impacted fracture of the femoral neck* may occur, possibly, in *conjunction* with dorsal dislocation. The head of the femur can be felt in its new situation on the back of the ilium; and the limb may be inverted or everted, and is shortened to the extent of the displacement of the head *plus* the impaction of the neck of the bone; but the neck being driven firmly into the great trochanter, *no mobility* or *crepitus* can be elicited by extension and inward rotation, and the *dislodged head* obeys the *movements* of the limb. This combined injury is thus distinguished from dorsal dislocation, accompanied with ordinary, unimpacted fracture of the

femur; and the limb can be *lengthened*, even by pulley-reduction effected, without unlocking the impacted bone,—which could not be accomplished, unless this state of fracture were with dislocation. After reduction, also, the limb remains shortened permanently, with great rigidity of the hip.

Dislocation Downwards and Forwards into the Obturator

—The head of the femur lies in front of the *Obturator Foramen*, the obturator externus muscle, the ball being directed into the great trochanter outwards. The capsule has given way, on its inner side, and the round ligament is torn from its seat; but the constancy of the latter lesion is disputed.

This dislocation, also, presents very characteristic appearances. The limb is *lengthened* from one to two inches in extent, the knee is *inclined forwards*—apparently to relax the painful psoas and iliacus muscle; and the whole limb is in *advance*, and much *abducted*; the foot usually points *forwards*, but it is slightly everted (Fig. 35). The head of the femur can be in a new situation, particularly in a thin person; and the prominent great trochanter has *disappeared entirely*, presenting a *marked depression* in the situation of the trochanter, but the limb is not drawn up towards the anterior superior iliac spine.

—The limb must be in a state of *flexion* at the moment of injury. Any force, or acting on the back, may then produce dislocation downwards and forwards, into the obturator foramen. Thus, a fall from the height of the thigh under the body of the patient had this effect; and Pirrie once caused by the person jumping in out of bed, and while the left foot was on the floor, the right was entangled by the bed, thus separating the legs and producing dislocation into the obturator foramen. The fall of a heavy weight upon the pelvis, when the body is bent forward, the thighs are apart, will also produce this dislocation.

TREATMENT.—(1.) The patient is laid on his back. The *extension* must be made *upwards* and *inwards*, by a perineal girth connected with the head of the bone, and counter-extension maintained by a band around the pelvis from the dislocated head of the bone. The head of the bone is thus drawn upwards and inwards, the Surgeon, passing his hand under the sound limb, grasps the ankle of the dislocated limb, and drawing it *inwards* and *backwards* towards the middle line, rotating *inwards*, so that the head of the bone outwards and upwards towards the acetabulum; observing not to flex the knee. The head of the bone should start into the ischiatic notch. The limb is

FIG. 35.



a long lever, over the resisting perineal girth, as a fulcrum.

In the absence of pulleys, however, it is well to have other resources as follow:—

(2.) Let the patient sit upon the front of the bed, astride one of the bed-posts, and grasp it; while extension of the limb is made by two assistants. Then, the Surgeon crossing the limb over the sound one, and rotating it outwards, may thus succeed in reducing the dislocation.

(3.) *Manipulation.*—Bigelow's precise directions are these:—"Flex the limb towards a perpendicular, and abduct it a little to disengage the head of the bone; then rotate the thigh strongly inwards, adducting as carrying the knee to the floor" (Fig. 36).

Dislocation Upwards and Forwards upon the Pubes.—The head of the femur rests on the anterior margin of the horizontal ramus of the pubic bone, with the great trochanter directed backwards. Sometimes, the ball is driven up so high as to be hooked into the pelvis. The capsular and round ligaments are ruptured. In a case dissected by S. A. Cooper, Poupart's ligament was torn, so as to allow the head and neck

FIG. 36.*



FIG. 37.



of the bone to pass underneath the iliacus internus and psoas muscles; the anterior crural nerve lying upon these muscles and stretched over the neck. The femoral vessels were to the inner side.

SIGNS.—The limb is *shortened*, generally to the extent of an *inch*; flexed slightly, decidedly *abducted*, and *everted* (Fig. 37). The globular head of the femur can be plainly felt on the *pubic bone*, to the outside of the femoral vessels, and made to roll under the fingers by rotating the limb; while the prominence of the *great trochanter* has *disappeared*, this portion of the bone being drawn *inwards* and *upwards* towards the *anterior superior spinous process* of the ilium. Immobility of the limb is

* After Bigelow.

ed symptom, as regards rotation inwards; and powerlessness equally pain or numbness frequently, owing to pressure on the anterior nerve.

diagnosis from *fracture of the neck* of the femur may be determined by the *situation* of the head of the bone and *immobility*, with in the case of fracture; or if the fracture be *impacted*, the head of is still diagnostic.

causes.—When the *limb* is directed *backwards*, and perhaps *abducted*, on upon the pubes may occur; either by a fall on the foot, as person slides down from the end of a waggon; or when walking, is suddenly planted into a hole, the pelvis advances, while the art of the body is thrown forcibly backwards, in order to avoid a severe fall on the back of the pelvis may have the same effect in ing dislocation upon the pubic bone.

TREATMENT.—(1.) The patient lying on his back, with the dislocated r the edge of the bed, *extension* should be made from the lower the thigh, *downwards* and *backwards*, the pulleys being fixed gly; while counter-extension, by means of a perineal girth, is the opposite direction, over the body of the patient. This force as usual, been applied slowly, gradually increased, and steadily ned, the *head* of the bone is *lifted* over the brim of the acetabulum vel under the upper part of the thigh, and the ball directed back- y rotating the thigh inwards.

Manipulation may be employed, and according to various t. Thus, Dr. Fountain, of Davenport, Iowa, succeeded in two s follows:—The patient lying on the floor, and under the influence of form, “the dislocated limb was seized by the foot and knee and outwards, the leg flexed and carried over the opposite knee and he heel kept well up, and the knee pressed down. This motion tinued by carrying the thigh over the sound one as high as the art of the middle third, the foot being kept firmly elevated. Then b was carried directly upwards by elevating the knee, while the held firm and steady, at the same time making gentle oscillations nce, when the head of the bone suddenly dropped into its socket.” manœuvres were executed with very little force, and occupied not han twenty or thirty seconds.

Unusual Dislocations of the Hip-joint.—The hip-joint is o several irregular dislocations, the head of the femur being y displaced upwards or downwards.

In *DISLOCATION UPWARDS*, the head of the bone may be displaced upwards, and be lodged *between* the anterior superior and anterior spinous processes of the ilium—*supra-spinous* dislocation; or per- low the inferior spinous process, at the junction of the ilium with ic bone—*infra-spinous* dislocation; or the displacement may be s and slightly *backwards*, the head of the bone lying just *behind* ch between the two anterior spinous processes—*anterior oblique* ion, so named from the oblique direction of the limb across the thigh.

Supra-spinous dislocation was attended with the following signs, se related by Dr. Cummins (“Guy’s Hosp. Rep.,” vol. iii.). It be observed that the *head* of the femur—*between* the anterior

spinous processes—is directed inwards towards the concavity of the ilium, the neck partly occupying the notch between the processes, and the great trochanter is turned backwards or everted (Fig. 38). Consequently, the limb is shortened by two or three inches, abducted and much everted, and so fixed in its position that rotation inwards is impossible, and abduction and adduction are difficult, although a limited flexion on the pelvis can be performed. These movements cause great pain. The head of the bone

FIG. 38.*



may be felt as a globular tumour, beneath the anterior superior spinous process; but the trochanter has disappeared, and the hip is flattened.

This "everted dorsal" dislocation of the hip-joint resembles ordinary capsular fracture of the neck of the femur, so far as it relates to shortening and eversion of the limb; but the presence of the head of the bone in its new situation—directly upwards, coupled with the absence of mobility and crepitus, when the limb is extended and rotated inwards, afford distinctive evidence that the Surgeon has not to deal with this common form of hip-joint injury. But if the supposed fracture of the femoral neck were impacted—thus accounting for the absence of mobility and crepitus—then the diagnosis

will be determined by the situation of the head of the femur in relation to the acetabulum.

Reduction.—1. With extension by pulleys in the axis of the dislocation, the head of the bone must be lifted out of the notch, at the same time, by means of a broad bandage around the upper part of the thigh, and slung round the neck of the Surgeon, who specially takes this part in the reduction. Then by adducting the knee to the opposite thigh, and rotating inwards, the head of the bone may slip into the acetabulum.

2. Or, reduction may be effected, as Bigelow observes, by a manipulative procedure, so as to convert the displacement into a Dorsal dislocation. By "circumduction of the extended limb inwards, with eversion enough to disengage it from the edge of the pelvis," the head of the femur passes on to the dorsum; but if the outer branch of the Y ligament is broken, the limb does not become inverted. Reduction of the dorsal dislocation may then be accomplished in the usual manner. Of these two modes of reduction, the former seems the more simple, and should certainly be tried before resorting to the production of a second dislocation, in order to reduce the first.

(b.) *Infra-spinous* dislocation, beneath the inferior spinous process, is similar; but the shortening of the limb is less, and it is rather adducted, even so that the heel may rest on the instep of the opposite limb, although greatly everted. The head of the bone can be felt under *Poupart's ligament*, but there is marked flattening of the hip from absence of the trochanter, it being turned backwards into the acetabular cavity. This form of dislocation would seem to be a variety of the Punct.

Reduction may be accomplished by extension of the limb, just to bring

* After Bigelow.

the head of the bone down opposite to the acetabulum, with forcible rotation inwards at the same time, to turn it into the cavity. Manual extension will be sufficient for this purpose, and then, by laying hold of the knee and foot, the limb can be used as a lever for the rotatory movement.

(c.) *Anterior oblique* dislocation is even more uncommon than the preceding forms of upward dislocation. The head of the femur resting on the ilium outside the notch between the two anterior spinous processes, the limb is shortened, as in supra-spinous dislocation, but it lies obliquely across the opposite thigh (Fig. 39), with some eversion, the great toe pointing outwards. This peculiar position of the limb may be produced by a modification of the ordinary DORSAL dislocation. In the reduction, therefore, Bigelow directs that the limb should be brought across the symphysis pubis, with a little eversion, if necessary, to disengage the head of the bone; when, by inward rotation, the displacement will be converted into a dislocation on the Dorsum Ilii. This must then be reduced.

(2.) DOWNWARD DISLOCATION, in irregular directions, has been met with in three forms: downwards and backwards, upon the posterior part

FIG. 39.*



FIG. 40.*



of the body of the ischium, between its tuberosity and its spine, or, into the lesser or lower ischiatic notch; directly or vertically downwards, beneath the lower border of the acetabulum, between it and the tuberosity of the ischium; or forwards, into the perineum, upon the ramus of the ischium and pubis, even as far as the body of the pubes.

(a.) Dislocation downwards and backwards upon the tuberosity of the ischium, or into the lesser ischiatic notch. This may be regarded as a variety of dislocation into the GREAT ISCHIATIC NOTCH. But the attitude of the limb is peculiar. It is marked by great flexion and adduction, with inversion, so that the thigh lies across the opposite thigh (Fig. 40); and the head of the bone may be felt just above the tuberosity of the ischium, at the back part of the hip.

The reduction is most readily brought about by a manipulative procedure: flex the thigh to a right angle with the pelvis, abduct, rotate inwards, and then bring down the knee; thus, in fact, retracing the altered position of the limb.

* After Bigelow.

(b.) *Vertically downwards*, beneath the acetabulum. *Subcotyloid* dislocation will also be recognized by the peculiar position of the limb; *vertical flexion* of the thigh to a right angle with the pelvis, and without any notable adduction or abduction, inversion or eversion (Fig. 41). The downward luxation may be considered as related to the typical form of THYROID dislocation.

A similar mode of *manipulation* to that in the last case, will probably succeed in returning the head of the femur into the acetabulum.

(c.) *Forwards and downwards*, upon the *ramus* of the *ischium*, or into the *perinæum*. Another form of THYROID dislocation, the attitude of the limb differs characteristically from that in the vertical dislocation. The thigh, somewhat flexed upon the pelvis, is in a state of *extreme abduction* and *eversion*; and the *ball* of the femur may be felt on the *ischiatric ramus*, or presents a *tumour* in the *perinæum* (Fig. 42).

FIG. 41.*



FIG. 42.*



Reduction may be performed by extension of the thigh downwards from the pelvis, with traction from the perinæum outwards, aided by the knee of the operator in the groin.

But the *manipulative* procedure which is adapted for a regular THYROID dislocation, will here also prove successful.

Dislocation of the Hip, with Fracture of the Femur.—This complication is undoubtedly possible, but very uncommon. Reduction of the dislocation would appear to be still more rare. The *rule of practice*, however, should always be to attempt reduction at the time of the accident. This may be accomplished, under the influence of chloroform, simply by pressure on the head of the bone and with the requisite manipulation; or by first setting the fracture and securing it with lateral splints, in order to make use of the limb for extension in reducing the dislocation. Failing at the time of dislocation to effect reduction, union of the fracture must be allowed to take place, and then it should be again attempted.

Dislocations of the Patella are liable to occur in four directions: (1) outwards more commonly, or (2) inwards; (3) vertically, the patella turning edgewise on its axis; or lastly, (4) upwards. Both the latter forms of dislocation are very rare.

* After Bigelow.

and 2.) DISLOCATION LATEROALLY, OUTWARDS OR INWARDS. The *usual conditions* in these two forms of Dislocation are analogous; the bone is displaced more or less completely in either direction, and rests on the outer side of the external condyle, or the inner side of the internal condyle of the femur.

Signs.—An unnatural swelling—the *projection* of the patella—can be felt over the *outer or inner condyle*, with an unnatural depression of the knee, owing to the absence of the bone from its proper position. The knee is much *broader* than usual, slightly bent, and immoveable; considerable pain also is experienced, especially aggravated by an attempt to bend the joint.

Causes.—*Muscular contraction* of the triceps extensor would seem to be the usual cause of these dislocations. The *outward* displacement is especially liable to occur in persons who are knock-kneed, or whose external condyle has not the usual degree of prominence anteriorly. Dislocation of the patella in this direction may sometimes be produced *spontaneously*. Displacement may arise from *distension* of the joint with *effusion of fluid*. *Indirect violence* is sometimes the cause; as a sudden fall on the thigh inwards, while the weight of the body resting on the patella, the leg turned outwards; or a fall with the knee turned inwards, the foot outwards. *Direct violence*, as a blow upon the inner or outer margin of the patella, may sometimes produce dislocation outwards or inwards, respectively.

These dislocations are very apt to recur.

Treatment.—Reduction is easily accomplished. But although permanent, or even remaining unreduced in a few cases, the use of the limb may be almost unimpaired. The patient lying on his back, the surgeon raises the thigh towards the abdomen, so as to *relax* the triceps extensor muscle; and then by *pressing* the *patella* inwards, or outwards, over the condyle, it is at once drawn into place by the action of the action muscle.

In VERTICAL DISLOCATION, the patella turns on its axis and is displaced edgewise. One margin looks forwards; the other rests on the femur in the groove between the condyles. This twist may be more or less complete; whereby the margin of the bone looks obliquely forwards, and is almost completely round so that the posterior surface of the bone becomes anterior. The latter displacement is very rare; and, indeed, vertical dislocation is very uncommon.

Signs.—Vertical dislocation presents very characteristic appearances: the sharp projecting border of the patella can be clearly felt and seen beneath the skin, and the leg is forcibly *extended*, or sometimes flexed.

Causes.—The same CAUSES may turn the bone vertically on its axis, which dislocate it laterally; and—as Hamilton states—an incomplete lateral may convert into a vertical dislocation, if the bone hitches on one margin, and the triceps extensor muscle contracts suddenly and violently, thus raising the patella, or even completely turning the bone on itself.

Treatment.—Reduction can sometimes be managed with tolerable ease, or it may be extremely difficult, and sometimes impracticable, the position of the patella being, it would appear, mechanically fixed in the acromioid fossa. The same method of reduction is applicable as for

lateral dislocation: relaxation of the muscles by raising the thigh, pressure on the patella, laterally on both margins, but in opposite directions. Or, *forcible flexion* of the knee, with rotation of the tibia on femur, may succeed; forcible flexion and extension alternately has proved successful, or a violent effort by the patient to make these movements. This failing, *subcutaneous section* of the tendon of the triceps and of the ligamentum patellæ has been resorted to.

(4.) Displacement UPWARDS can only result from relaxation, or rupture of the ligamentum patellæ; thus permitting the patella to glide upwards in front of the femur. I have seen this happen once, from forcible flexion of an ankylosed knee-joint.

The SIGNS of such displacement are sufficiently obvious. The patella is drawn upwards, an interval appears below it, or a fold inwards; the leg is placed in an extended position; there is also marked weakness of the leg and proportionate loss of extensor power, the leg hanging down nearly useless and swinging to and fro like a pendulum.

The TREATMENT is the same as for fractured patella or rupture of triceps tendon. In the case referred to, the power of extension was partially recovered.

Dislocations of the Knee-joint.—This joint is seldom dislocated; nevertheless, the head of the tibia is liable to undergo dislocation in the principal directions, and in the following order of relative frequency: inwards, (2) outwards, (3) forwards, (4) backwards. The first two dislocations are always incomplete, with one or two very rare exceptions; the latter two dislocations may be incomplete or complete.

(1.) DISLOCATION OF THE TIBIA Laterally, OUTWARDS; the internal condyle of the tibia rests upon the external condyle of the femur, the lateral ligaments are more or less completely ruptured. (2.) DISLOCATION Laterally, INWARDS; the external condyle of the tibia rests upon the internal condyle of the femur, and the lateral ligaments are more or less entirely ruptured.

(3.) DISLOCATION OF THE HEAD OF THE TIBIA, FORWARDS; the head is situated partly, or entirely, in front of the condyles of the femur, according as the dislocation is incomplete or complete. The condyle of the femur projects, proportionately, backwards in the popliteal space.

(4.) DISLOCATION OF THE HEAD OF THE TIBIA, BACKWARDS; the head is situated partly upon the posterior half of the condyles of the femur, or it passes up and rests against the posterior aspect of the articular surfaces, according as the dislocation is incomplete or complete. The condyles of the femur project, proportionately, forwards.

In both the latter dislocations, (3 and 4), it is probable that the ligaments and surrounding structures are similarly injured. Thus, in backward dislocation, the posterior ligament of the joint is torn, the muscles of the ham are stretched, and the popliteal vessels and nerves compressed. In complete dislocation, the crucial or inter-articular ligaments are also torn; the anterior ligament, with forward dislocation; the posterior ligament, with backward dislocation.

SIGNS.—(1.) Dislocation laterally, *inwards* or *outwards*, present opposite appearances. In the one, an unnatural swelling—the internal condyle of the tibia—on the inner aspect of the knee; and another swelling—the external condyle of the femur—on its outer aspect. In

dislocation, or outwards, an unnatural swelling—the *outer condyle of the tibia* and head of the fibula—is found on the *outer* aspect of the knee, and another swelling—the internal condyle of the femur—on its *inner* aspect. In both forms of dislocation, the leg is slightly flexed, or sometimes extended, and *inclined* inwards or outwards, *towards* the side of dislocation, but *not* shortened in its long axis. Immobility, with inability to use the leg, and severe pain, are present, as, more or less, in all dislocations.

2) Dislocation *forwards* or *backwards* also presents opposite appearances.

In the one, a large swelling—the bulky *head of the tibia*—projects in *front* of the knee, with a deep depression immediately above it under the patella; and another large swelling—the condyles of the femur—in the *popliteal* region. In the backward dislocation, a large swelling—the bulky *head of the tibia*—can be felt in the *popliteal space*; and another large swelling—the condyles of the femur—in front of the knee, with a deep depression below in the situation of the ligamentum patellæ. In these forms of dislocation, the leg is bent; in the one case, slightly *back* upon the thigh; in the other, extended or bent unnaturally *from* the line of axis of the femur; shortening also is conspicuous, if either dislocation be *complete*, and varying in extent from one or two inches, or more. Severe pain, and swelling of the limb, may arise from compression of the popliteal nerves and vessels.

CAUSES.—All these dislocations of the knee usually arise in like manner. *Indirect* violence is, perhaps, the most frequent cause; as when the knee is made fast in a hole, and the tibia twisted upon the femur by a sudden swinging around upon the knee; or by a fall from some height, or the individual jumping from a carriage in motion. *Direct* violence is caused by a blow upon the upper end of the tibia, or upon the lower end of the femur. Similar dislocation, or a tendency thereto, is an uncommon result of disease of the knee-joint, with retraction of the ligaments, or the use of the end of the femur to project forwards in standing or walking.

TREATMENT.—Reduction can be accomplished, in the same way, in all forms of dislocation of the knee. *Flexing* the thigh towards the knee, and fixing it for counter-extension, *extension* is then applied to the leg, in the *direction* of the *long axis* of the displaced *tibia*; pressure is made, at the same time, on the ends of the bones in opposite directions, so as to overcome the displacement. Splints should be employed on both sides of the joint, and the appropriate measures also for subduing the inflammatory swelling, which is often considerable. At the end of two, or four weeks, according to circumstances, passive motion may be gently at intervals, and the joint allowed gradually to resume its normal state.

Manipulation will perhaps succeed in effecting reduction, when the dislocation is incomplete and recent. The leg should be carried in whatever directions it moves most readily; or, this failing, forced flexion and extension may be tried, at the same time twisting the leg a little from each side, with pressure upon the ends of bone in opposite directions, to effect about replacement.

INTERNAL DERANGEMENT OF THE KNEE-JOINT—so named by Hey, who first described it—or subluxation of the knee, sometimes so called.—This accident is not uncommon.

The *structural condition* is, probably, a partial dislodgment of the semilunar cartilage, owing to a *disruption* of its ligamentous connection with the margin of the condyle; the thick margin of the cartilage thus becoming interposed between the articulating surfaces of the condyles of the femur and tibia; or, part of the cartilage slipping, or behind the condyle, the articular surfaces are brought into contact in an analogous condition, in relation to the symptoms thence arising, and occur, by the interposition either of a *fragment* of one of the cartilages, or of an *hypertrophied portion* of cartilage, or of a *false cartilage* formation, moving about more or less freely within the joint.

SYMPTOMS.—Sudden inability to use the joint is felt, which is increased, while walking, or by striking the toe against something, tripping the foot. Intense and nauseating pain accompanies this locking of the joint, and the person falls to the ground. Any slight flexion of the leg, as in bed, by the mere weight of the bed-clothes hanging over the toes, has been known to produce the same effect. In either case, the joint is slightly flexed, and the leg perhaps somewhat rotated. Considerable swelling of the knee rapidly supervenes, and the synovial capsule distended with fluid; in short, subacute synovitis ensues from this condition.

It is very likely to recur, again and again; thus rendering the prognosis unfavourable.

TREATMENT.—This "internal derangement" disappears, in most cases as easily as it was produced. *Flexion*, with *sudden extension*, and *rotation* of the leg, will generally overcome the difficulty, if it should not suddenly right itself. Immediately, the motions of the joint become free and painless, so that the individual can walk about as if nothing had happened. But it is better to place the joint at rest for a while, to subdue any synovitis which may have supervened, and to support the knee for some time by means of a knee-cap, to guard against the liability of recurrence.

COMPOUND Dislocation of the Knee-joint.—This injury must be regarded as the most perilous of its kind, but fortunately it is of rare occurrence.

TREATMENT.—An attempt to preserve the limb will scarcely ever be successful; and, excepting in a few cases of more limited damage to the popliteal vessels, nerves, and the integuments, where excision may be sufficient, amputation is the only resource.

Dislocations of the Head of the Fibula.—The upper end of the fibula may, occasionally, be dislocated *forwards* or *backwards*. In the former dislocation, Malgaigne has collected three examples, none of which were reduced, and with any other accident, and not apparently due to any abnormal condition of the ligaments. I have seen another, or fourth, such dislocation which had remained unreduced. Of backward dislocation, Hamilton enumerates three cases on record.

The **SIGNS** of these dislocations are very palpable; the *projection* of the bone immediately under the skin, forwards or backwards, and the *swelling* of the joint, fail to be observed.

The **CAUSE** is almost necessarily direct violence, as a blow on the knee, or the fibula. But muscular action is said to have produced two, and of the three forward dislocations.

The consequence of any such dislocation may be a laxity of the ligaments, with mobility of the fibula backwards and forwards upon the tibia.

MENT.—Reduction having been effected by pressure, the head must be kept in place by a compress and bandage.

Dislocation of the Lower End of the Fibula.—The only instance of this dislocation is related by Nélaton as having occurred in the person of M. Gerdy. It was a *backward* dislocation of thirty-nine lines, and caused by the wheel of a carriage passing obliquely over the leg so as to displace the outer malleolus, backwards. The head of the fibula remained in almost direct contact with the outer margin of the tendon of the peroneus, the *outer face* of the *astragalus*, abandoned by the fibula, could be felt, and the position of the foot remained unaltered. The patient walked pretty well, the bone was fixed, and reduction not attempted.

Dislocations of the Ankle-joint.—The *astragalus* in connection with the *tibia* may be dislocated from the articular ends of the *tibia* and *fibula* in four directions: (1) outwards, (2) inwards, (3) forwards, and (4) backwards. They may be termed dislocations of the foot in these directions. Most of these displacements are accompanied with fracture of the *tibia*, or of both bones. The description of these several forms of dislocation will, I think, be simplified by regarding at least some of them as displacements of the *astragalus* and *fibula* in various directions, as relating to the *tibia*.

Dislocation Outwards.—The lower end of the *tibia* is displaced outwards upon the *astragalus*; the outer portion of the articulating surface of the *tibia* resting upon the inner portion of the upper articulating surface of the *astragalus*, or it may slide completely off in the same direction.

The foot is turned outwards—*everted*. The *internal lateral ligament* is ruptured, but not perhaps completely, or the inner malleolus is broken, or both; the *fibula*, also, usually gives way two or three lines above its articulation with the *astragalus*. Sometimes, in addition to these injuries, there is an *oblique fracture* of the *tibia* upwards and outwards from the articulating surface, breaking off that portion of the *tibia* which corresponds to the *inferior tibio-fibular* articulation; this fragment remaining connected with the outer malleolus, while the *tibia* is displaced forward with it the portion of the *fibula* above the fracture.

Simultaneously, the *astragalus* undergoes a *lateral rotation inwards*, its outer and upper margin glides beneath the middle of the articulating surface of the *tibia*; thus presenting the outer or fibular surface of the *astragalus* obliquely upwards, while its inner and upper surface is carried downwards towards the end of the inner malleolus.

Dislocation Inwards.—The lower ends of the *tibia* and of the *fibula* are displaced laterally outwards, and perhaps completely, the articulating surface of the *tibia* entirely sliding off the upper surface of the *astragalus*. The *inner malleolus* is broken off the *tibia*, but remains attached to the tarsus by the *internal lateral ligament*; and the *external lateral ligament* is ruptured, or the outer malleolus may be broken off the *tibia* making a fracture of both malleoli. The foot is turned inwards—*inverted*.

The *astragalus* may undergo *rotation outwards*, analogous to that in the case of a *lateral* dislocation; here, its inner or tibial malleolar surface looks upwards.

Dislocation Backwards.—The lower end of the *tibia* is displaced backwards on the *astragalus*, resting partly on this bone and partly on the *fibula*; or completely forward, the *tibia* then resting on the

on the os calcis. The lateral ligaments are ruptured, or one or both are broken.

SIGNS.—Dislocation laterally, outwards or inwards, presents appearances. (1.) *Outward* dislocation is characterized by *version* of the foot, its inner margin being directed downwards; *malleolus* projects prominently under the integuments, and corresponding depression above the outer malleolus, in the case of fracture of the fibula. *Crepitus* may here be detected, and the foot be moved about pretty freely by the Surgeon, but with great pain. *Inward* dislocation is distinguished by *inversion* of the foot, its outer margin looking downwards; and the *outer malleolus* projects under the skin.

Dislocation backwards and forwards also presents opposite appearances. (3.) *Backward* dislocation is attended with *shortening* of the foot, the *heel* is *elongated*, the *toes* are *depressed*; while the *heel* is *elongated* and *drawn upwards*. The *extensor tendons* are *sharply defined*, and the *tendo-Achillis* is *curved tensely* for the foot is immovable. These signs are even more marked with *backward* dislocation; the end of the tibia can be distinctly felt projecting accompanied with an evident depression posteriorly in front of the *Achillis*. (4.) *Forward* dislocation is characterized by *lengthening* of the foot in front of the tibia, and *elevation* of the *toes*; with *obliteration* of the *heel*, which is in a line with the back of the foot *depressed downwards*. A portion of the articulating surface of the *talus* may be felt in front of the tibia.

CAUSES.—*Direct* violence, as a severe twist or wrench of the foot outwards or inwards, represents the ordinary mode of producing lateral dislocation; the displacement taking place, obviously in the *opposite* direction to such force. *Indirect* violence, as a fall from a height upon the bottom of the foot, may have a similar effect; if the force be sufficient inclination to either side, to thus direct the force of

ns of dislocation are accompanied with fracture of the articular ends the tibia and fibula, the displacement may be partly due to muscular on,—the contraction of the flexor muscles of the foot. Luxation may before occur at the time of the accident, or be consecutive to the fracture.

TREATMENT.—All these dislocations are reduced in like manner. The should be *flexed* to a *right angle* on the thigh, to relax the conjoined *peroneus* and *soleus* muscles; *extension* is then made from the *foot* line with the long axis of the leg, taking care that the foot inclines way between flexion and extension of the ankle-joint, and by drawing a one hand on the back of the foot and the other hand on the heel, or ting extension by means of pulleys. *Pressure* on the end of the tibia, ording to the direction of the displacement, will further aid reduction. simply lateral *rotation* of the *astragalus*, with the foot turned outwards inwards, the Surgeon will often succeed by grasping the foot with ible *adduction* or *abduction*, thus to undo the displacement. After action in any case lateral splints with foot-pieces may be applied; but refer a McIntyre's trough-splint, as affording a more equable support the whole leg. The swelling around the joint is often considerable; however, subsides under the influence of rest and the usual topical dications.

Compound Dislocations of the ankle-joint are probably the most amon of all compound Dislocations. Among the cases recorded by

A. Cooper, forty-five were dislocations of this joint; and among milton's cases, four were dislocations inwards, and one a partial dislocan forwards. The *displacements* are the *same*, and arise from the same uses, as in simple dislocation of the ankle; but compound dislocation gives its importance from the size of this joint, and the violence of the ury.

TREATMENT.—Preservation of the foot—without any operative interence—proves successful in a far larger proportion of cases than in ilar injury to the knee-joint. The *wound* should be *closed* and the kept at rest on a McIntyre's splint. *Protrusion* of the tibia, with comnution, as often happens in backward dislocation, allows of *excision* in et cases. But severe contusion or laceration of the soft parts, including ury to the tibial arteries—in addition to compound dislocation of the nt—imperatively demands primary *amputation*. The usual conseences of inflammation, suppuration and sloughing, or gangrene, may nder *secondary* amputation necessary, when an attempt to save the foot s failed.

Dislocations of the Astragalus.—This bone is sometimes displaced en under the tibia, and thrown—(1) forwards, (2) inwards, or (3) outwards; the two latter displacements probably being *inclinations* of the ne forwards in either of these directions, thus constituting two lateral dislocations; and occasionally it may be displaced (4) backwards. It may so be simply *rotated* on its lateral axis without much, if any, lateral placement; and, lastly, it is sometimes driven *upwards* between the ia and fibula, tearing away the intermediate ligaments and generally *returing one or both* of these bones.

(1, 2, 3.) Dislocation *forwards*, and *inwards* or *outwards*, may be mplete or incomplete. *Complete* dislocation of the astragalus represents e detachment from the os calcis and scaphoid bones, and its displacement

from under the malleolar arch forwards; the bone lying upon the *scaphoid* and *cuneiform* bones. *Incomplete* dislocation signifies the separation of this bone from the *scaphoid* only, and the ejection of its head on the external *cuneiform* or *cuboid* bones; the body of the astragalus retaining its connection with the *os calcis* and malleolar arch (Fig.

(4.) Dislocation backwards is a dislodgment of the astragalus from the *os calcis* behind the *tibia*, in the interval between it and the *Achilles*.

Signs.—The projection of the astragalus which can be felt in each of these directions of dislocation, is alone sufficient to indicate

FIG. 42.*



nature of the injury. The mal-
position nearer the sole of the foot, the
having fallen down upon the *os*
and there may be some flexion
tension of the foot, according as
location is forwards or backward
in the former, if the direction
astragalus be *outwards*, there
marked *inversion* of the foot to
angle, with a *deep sulcus* or groove
the integument at the *inner malleolus*.
Such, at least, was the characteristic
attitude of the foot in the two
have seen.

The CAUSES of astragaloid dislocation
resemble those of ankle-joint dislocation.
Thus, a fall from a height upon the
bottom of the foot, accompanied by
violent abduction, adduction, and

or extension; may determine a dislocation of the astragalus—flexion
and inwards, or outwards; or backwards. A wrench or twist of the foot
in machinery or in the wheel of a carriage, for example, is another
of production. A direct blow may also be the cause.

TREATMENT.—Reduction—when practicable—can be accomplished in the
the same manner as in dislocations of the ankle. Flexion of the foot to
a right angle with the thigh relaxes the muscles of the calf; and
extension from the foot, with counter-extension from the lower
the thigh, aided by pressure on the displaced bone, will perhaps
it. Division of the *tendo-Achillis* has facilitated replacement in all
cases, which have occurred in my own experience.

The probability of effecting reduction depends very much upon the
dislocation being *incomplete*; complete dislodgment of the bone is
very difficult to overcome. The *tibia* and *os calcis*, powerfully
together, can hardly be separated to an extent sufficient for the
of the bulky astragalus; itself also bound down by the extensor
in forward dislocation, and by the *tendo-Achillis* in backward dislocation.

Should reduction have proved impossible, the integument over the
projecting astragalus will probably slough and expose the bone, occasion-
cipating this result, it is better forthwith to proceed to *excision*,
the dislocation be simple.

* St. George's Hosp. Mus., 1, 212.

COMPOUND Dislocation presents no peculiarity otherwise than the serious nature of the injury, from exposure of the bone, and as mentioned by more severe violence. I have seen one such case,—a compound dislocation of the astragalus forwards and inwards on to the cuboid bone.

Excision or amputation are the only alternatives. The results of the former operation have been so successful as to warrant its preference in all.

Dislocations of the other Tarsal Bones.—Such dislocations are rare. (1.) The *Calcaneum* may, however, be dislocated *outwards* from the astragalus alone, or from the cuboid bone simultaneously, in *addition outwards and upwards*. Dislocation of the *os calcis* and *cuboid bones backwards* from the astragalus, has also been verified by section.

The *deformity* in these dislocations is sufficiently characteristic to state the nature of the injury, in either case.

2.) The *five anterior tarsal bones* were dislocated from the *os calcis* the astragalus,—the fore part of the foot being twisted inwards, in a remarkable case recorded by Sir A. Cooper.

3.) The *Scaphoid* and *Cuboid* bones, together, may be dislocated from the astragalus and calcaneum *upwards*—the middle tarsal dislocation Malgaigne. The foot is shortened, and the instep raised; presenting deformity of club-foot. This injury also has arisen from a fall, but not on the ball of the foot.

The *cuboid bone alone* may, it is said, be dislocated upwards, inwards, downwards; but Malgaigne has found no case recorded of this dislocation alone, unaccompanied with that of one or more of the other tarsal bones.

The *scaphoid bone alone* has been found dislocated from the *cuneiform bones*, its connection with the astragalus remaining undisturbed. The dislocation was compound, yet—after reduction—the wound healed rapidly, and recovery soon became established.

Dislocation of the *scaphoid* from both the *astragalus* and *cuneiform bones* has occurred in several instances.

4.) The *Cuneiform bones* may be partially dislocated, and without being separated from each other; of which two or three examples are recorded. The *internal cuneiform bone alone* has been displaced inwards. Section, corresponding with the displacement, will declare the nature of the injury.

The **TREATMENT** of all these dislocations of the Tarsal bones is the same. *Reduction* may possibly be effected by *pressure* on the displaced bone. A compress and foot-splint will then be required to allow the bone to gain its ligamentous connections. Fortunately, in the event of some of these dislocations remaining unreduced, the use of the foot has been little affected.

COMPOUND dislocation of any of these tarsal bones may occur, but arises only from direct violence. Reduction has been accomplished, followed by recovery with only slight lameness. Otherwise, *excision* or *amputation* must be resorted to, according to the amount of crushing injury.

Dislocation of the Metatarsal Bones is also very rare. (1.) The

metatarsal bone of the *great toe* has been dislocated upwards, an instance of which from direct violence was seen by Liston and reduced. (2.) The *inner three* metatarsal bones were dislocated downwards and backwards, in a case recorded by Tufnell, and as resulting from a fall upon the leg by a horse rolling on its rider; and South mentions a case, in which the outer two metatarsal bones were dislocated upwards and backwards. (3.) Dislocation of *all* the bones backwards has occurred in the experience of Bouchard, Meynier, and R. W. Smith; downwards, as Smily relates; outwards, in a case which Laugier met with; and inwards, in a case seen by Kirk. In the backward dislocation, it appears from Dr. Smith's specimens, that the internal cuneiform—in connection with the first metatarsal bone—is also displaced backwards, on to the scaphoid bone.

The SIGNS of any single dislocation will be the particular deformity occasioned by the direction of displacement. When *all* the metatarsal bones are dislocated, say *backwards*, the *dorsum* of the *foot* is *foreshortened* and presents a *transverse ridge*, about one inch below the front of the ankle-joint, a superficial furrow intervening between this ridge and the joint; while a *corresponding prominence* appears on the *plantar surface*, instead of the concavity of the arch; but this transverse ridge is ill-defined, being produced by the projection of the tarsus downwards, with bulging of the plantar tendons. Of these two ridges, the upper is most prominent internally; the under one, externally. The *foot* is *inverted* to some extent,—the plantar surface looking inwards, and the outer margin downwards; but only the *central third* of the margin touches the ground—according to Dr. Smith's observations.

DIAGNOSIS.—1. This is a feature of *distinction* between dislocation of the metatarsus backwards upon the tarsus, and dislocation of the (*whole*) foot inwards, the outer margin of the foot, in its *whole length*, then resting on the ground. 2. From dislocation of the foot backwards, with foreshortening, the *distinguishing peculiarity* is the *absence* of any *depression* of the *heel*, in the metatarsal luxation.

The CAUSES are usually a fall backwards or forwards, the anterior extremity of the foot being wedged under some resisting body. Various crushing accidents also sometimes occasion these dislocations.

The TREATMENT must be conducted on ordinary principles. Single dislocation can be reduced only with considerable difficulty, the bone not being accessible to extension, and it has remained unreduced in the hands of Malgaigne and other Surgeons. Multiple dislocation has proved far more easy of reduction. In each of the directions of displacement, involving *all* the metatarsal bones, it was readily accomplished by *extension*, combined with *pressure* suitably applied.

Dislocations of the Phalangeal Bones of the Toes resemble those of the fingers, and do not require a separate notice. (1.) In a case related by Sir A. Cooper, *all* the *smaller toes* were displaced *backwards*; a projection existed at the roots, and the extremity of the metatarsal bones bulged under the first phalanx of the corresponding toes. The displacement had been caused by a fall from a considerable height, upon the ends of the toes. Several months had elapsed, and reduction could not be effected. Walking was rendered more tolerable by wearing a piece of hollow cork at the bottom of the inner part of the shoe, to prevent pressure of the metatarsal bones upon the nerves and blood-vessels.

(2.) The *great toe*—like the thumb—may be dislocated *backwards*, the posterior end of the first phalangeal bone resting on the corresponding metatarsal bone. I have had one such case. The projection backwards was very obvious, and the ungual phalangeal bone was flexed to a right angle, by the action of the long flexor of the great toe. *Reduction* was easily accomplished, by slight extension, coupled with pressure on the phalangeal projection, forwards.

CHAPTER XXXII.

DISEASES OF JOINTS.

UNLIKE Diseases of Bone—wherein the osseous texture or bone proper, the periosteum, and the medullary membrane or endosteum, are *less separately* and distinctly the seat of any particular morbid condition—Diseases of Joints relate to the synovial membrane, the articular ends of bone, and the articular cartilages, not to mention the ligaments, as, *severally*, the *seats* of disease; although any such morbid condition, isolated primarily, often spreads to the adjoining structures secondarily. Thus, the component structures of the joints have each an individuality in relation to Disease; and Diseases of the Joints have reference essentially to these component structures.

Synovitis.—Inflammation of the Synovial Membrane.—An inflamed *synovial membrane* is more *vascular* than natural, in the form of *crimson spots* or diffused redness, and loses its glistening appearance. The *synovial secretion* is increased in quantity, and thinner or serous. These are the earliest changes. As inflammation proceeds, the membrane acquires a *pulpy thickening* and opacity, by interstitial exudation, and fibrinous lymph is effused from its inner surface, giving it a *granular* or *villous* appearance, and forming *flakes* in the synovial fluid, which also accumulates in quantity. Sometimes, the fluid becomes milky or creamy, from the admixture of emigrated leucocytes, and which may form *gelatinous concretions*, unlike the flakes of lymph. The fluid may be blood-stained, in *traumatic synovitis*. Some effusion occurs in the *perisynovial cellular tissue*; giving additional thickening around the joint, of an oedematous or more solid character, according to the serous or fibrinous nature of the effusion. *Fibrinous effusion within* the synovial capsule, represents the *adhesive* stage of synovitis; an event, however, which rarely supervenes, as the opposed surfaces of the interior of the capsule become yet more separated by its increasing distension. Subsequently, *pus* may be secreted within the capsule, which thus becomes converted into an *abscess*.

SIGNS.—ACUTE SYNOVITIS.—The knee-joint may be taken for example, as it is more commonly affected than any other joint. (1.) Coincident with the earliest stage of inflammation, *pain* is experienced by the patient, and usually referred to a particular spot, perhaps the *inner edge* of the *patella*; afterwards extending over the whole articulation. In other joints, painful spots may, at first, be detected; especially where the

articulation is superficial. In the *elbow*, behind the joint, about the head of the radius. In the *ankle*, before or behind the outer malleolus. In the *wrist*, at the back, outside the index extensor tendon. Deep joints have less definite spots of tenderness; in the *shoulder*, under the acromion; behind the great trochanter, or outside the ramus of the ischium, when the *hip-joint* is affected. The pain has no specially distinctive character. It is severe in proportion to the depth of the articulation and the unyielding nature of the ligamentous and other surrounding structures. It is also most intense in synovitis of a rheumatic or gouty origin, and as if the joint were compressed by a vice, or being violently torn open. (2) In a period varying from two or three hours to as many days, according to the intensity of the inflammation, *swelling* makes its appearance. The *consistence* and shape of this synovial swelling are characteristic. At first fluid and fluctuating, it becomes semi-solid as lymph is effused, and again resumes its original fluidity in the event of serous collection, or of suppuration. But the *shape* of this swelling is even more remarkable. Throughout the course of synovitis, it corresponds to the shape of the

FIG. 44.



synovial capsule; presenting that outline more clearly according to the degree of distension, and as modified by the compression of surrounding ligaments and tendons. The swelling, therefore, varies in form with each articulation, and its relation to the ligaments and tendons. Thus, in the *knee*, the swelling of synovitis is most conspicuous as a protrusion on either side of the ligamentum patellæ, betwixt it and the lateral ligaments, and rising above the patellæ, bulges in a uniform shape, or laterally, as high as the distended capsule may extend (Fig. 44). The *patella* is floated up from between the condyles, and when depressed with the finger, it rises again. In the *elbow*, the swelling projects on the posterior aspect of the joint, above the olecranon, and under the extensor muscles of the forearm. In the *ankle*, it presents on each side, between the lateral ligaments and the anterior tendons. In other joints less superficial, as the *shoulder* and *hip*, the swelling of synovitis is less perceptible; in the one being

obscured by the cushion of deltoid muscle, which appears more developed than on the sound side; in the other, however, an evident fulness of the groin, and sometimes of the nates, can be detected, or bulging may be felt behind the great trochanter, and perhaps on the inner side, in the fold of the thigh and perinæum. The *wrist-joint* is far less frequently subject to synovitis; but here a general fulness and some bulging between the tendons—extensors and flexors—shows a conformity to the rule of characteristic swelling. *Perisynovial swelling* has a uniform appearance, or presents no special shape; it does not fluctuate, but is *ardematous*—pitting on pressure. Heat and, possibly, redness of the skin around the

Thus, the pain is elicited by touching, lightly handling, or bending the joint, but not provoked by pressing or concussing the heel upwards, to bring the articular ends suddenly into contact; and this surface-pain often extends upwards on the thigh, and down the leg to the foot. Periodic pains in the muscles are also experienced, rather than concussive startings of the limb, as when ulceration of the articular cartilages has taken place. All pain may cease at times, and recur; or it migrates locally, and settles in some other part; and then the simulated disease ceases. The variations of colour and temperature are also significant; the limb being perhaps pale or of a purplish hue, and cold, in the morning, and becoming warm or hot to the touch, with a reddish, shining surface in the evening. A slight puffy swelling may supervene on the evening pain, and as this puffiness corresponds to the margins of the articular cartilages, on either side of the patella, it looks as if the joint were affected. Generally, the limb is quite extended. While, therefore, the circumference of the joint possibly resembles that of articular disease, the position of the limb usually differs from the semi-flexed position in that condition. The globular enlargement of the joint, with a half-bent position of the limb, in carious disease of the articular ends of bone, will also sufficiently distinguish that condition. But the peculiarities of steric pain—in its severity, its superficial, diffused, and fitful character, with the changes of colour and temperature in the part—are rather unlike the symptoms of any joint-disease, whether affecting the articular ends or the bones. Add to which, the constitutional health remains unimpaired, as by the symptomatic fever of inflammation, or hectic of prolonged suppuration, in the early and advanced stages of articular disease; and this difference of constitutional condition becomes highly significant in its relation to the extent of the presumed disease and its duration. Chloroform lends invaluable aid in determining the diagnosis; under its influence, pain and functional disturbance being removed, the presence or absence of structural disease can be more conclusively ascertained. The knee and hip joints are most frequently

fall, sprain or wound, may give rise to acute synovitis. The disease occurs in joints which are most superficial and exposed, as the elbow, sometimes the ankle or hip, occasionally the wrist or joint. 2. But these causes are usually backed by some predispositional condition; especially rheumatism, scrophula, constitutional or hereditary, by the poisonous administration of mercury. Several may then be affected simultaneously.

3. Inflammation of the synovial membranes also ensues, often from gonorrhoea or purulent ophthalmia. Such synovitis has correctly regarded as a form of "gonorrheal rheumatism," although apparently depending on a rheumatic condition. Gonorrheal would be a more correct designation. Arising after gonorrhoea end of a week or two, or at the later period of gleet, and general sudden arrest of the discharge, it affects one or more joints—the knee, and often both knees. Serum rather than lymph is effused into the joint, and the disease terminates without disorganization weeks. Or it proceeds, sometimes, to ulceration of the cartilages continues for months or a year or two.

4. Pyæmia induces a low inflammation of the joints, the special of which is its abundant sero-purulent effusion, and consequent unattended by pain, heat, and redness, the ordinary symptoms of inflammation. Ulceration of the cartilages ensues if the patient survives long enough.

5. Blood-poisoning, apparently from the absorption of various morbid matters, may also give rise to synovitis. Thus, in cases with irregular or suddenly suppressed menstruation—as catamenial synovitis; from uterine absorption during pregnancy or after parturition—metric synovitis; or as the sequel of some exanthematous fever, such as pox, scarlatina, or measles; or from diphtheria, wumps, or erysipelas. In all such cases, more than one, perhaps many joints are affected. Inflammation of the synovial membrane is polyarticular.

on has been named *hydrarthrosis* or *hydrops articuli*—dropsy of it. Some lingering vascularity and redness, with thickening of synovial membrane, remains. The knee-joint is most commonly affected; rarely the hip, shoulder, or elbow. But the same accumulation of synovial fluid may attend other conditions of joint-disease, though not representing the essential element of the disease; as in the stage of chronic rheumatic arthritis, or the formation of a false joint in a joint.

Suppuration and *abscess* having occurred, the joint is distended with thick, opaque, yellow pus; the *synovial membrane*, very red and thick, is ulcerated in parts, and overspread with fibrinous purulent matter; the *articular cartilages* undergo ulcerative disintegration into a soft pulp, here and there, or the cartilage readily peels off; and the *joint bone* is very vascular, and liable to become carious—thus leading to total disorganization of the joint; or *ankylosis* supervenes—sometimes fibrous and stiffly movable, sometimes bony and fixed. Or, the *articular abscess* opens, and ankylosis may then take place, as a possible termination; but death is liable to result in the course of the disease to be presently narrated. *Periarticular* abscesses may form; in the *synovial bursæ* adjacent to the joint, or in the *subcutaneous cellular tissue*, then having more the character of a diffuse suppuration. When the knee-joint is affected with acute purulent synovitis, the *bursa* under the *ligamentum patellæ*—or tendon of the *triceps muscle*—the *bursa* in the *popliteal space*, may suppurate in the form of an abscess; while, in the *subcutaneous cellular tissue*, suppuration may take place up the thigh and down the leg. These *periarticular abscesses*, however, occur independently of, although consequent on, the purulent synovitis; but they may subsequently *communicate* with the joint, and finally the *bursal abscesses*. Hence, according to the nature of the disease, the *puncture* of the joint might yield pus in one situation, or only in another part.

Purulent synovitis may be *acute* or *chronic*, according to the severity of the irritation of the symptoms; as depending chiefly on local or constitutional causes, *e.g.* injury or *scrofula*.

TREATMENT.—Absolute *rest* of the joint should be observed, as primarily important; the limb being placed in that *position* which is most comfortable to the patient, and most convenient in the event of any stiffness arising. A somewhat flexed position will, generally, best answer the purpose. The limb may be sufficiently steadied by laying it on a soft pillow, which thus partially envelops the joint; or a suitable bandage should be applied to insure rest. Thus, for the *knee* or *ankle*,

special treatment for rheumatism, constitutional syphilis, or other causative condition, may be requisite.

GONORRHEAL SYNOVITIS is amenable to the same treatment arising from rheumatism. Thus, colchicum and alkalies or iodine and potassium often prove remedial. But the disease, in most cases, runs its course; or a change of climate from a cold and damp atmosphere to the southern coast, may be followed by a speedy subsidence of the symptoms.

CHRONIC SYNOVITIS must be treated with a view to the removal of accumulated effusion, and consequent weakness of the joint. *Counter-irritation* in the form of blisters should be employed to overcome persistent inflammation; followed by stimulating embrocations and *pressure* to promote absorption. The blisters should not be applied directly over the inflamed joint, but in the neighbourhood. Thus, in the case of the knee, a blister applied on either side of the thigh just above the joint; and with regard to the hip, a blister may be placed on the greater or lesser trochanter or on the nates. Of stimulating embrocations, a liniment of turpentine, olive oil, or the *iodine paint*, are perhaps most useful. Pressure may be applied by means of a gutta-percha or pasteboard splint, moulded to the joint; or the joint may be strapped with soap-plaster spread on leather. The *emplastrum ammoniaci cum hydrargyro* combines both stimulation and pressure. I now generally use a *dressing* of blue mercurial ointment and camphor, which, with *strapping*, affords equal support, and is more beneficially stimulant. *Injections* into the joint with tincture of iodine has been much employed by V. Jobert, and Bonnet. The tincture is diluted with two or three times its volume of water. But purulent synovitis may thus be induced. *Distention* of the synovial capsule may be relieved by aspiration, or subcutaneous puncture, either procedure being followed by compression. Free incision to lay open the joint, antiseptically, has also been practised with success. *Constitutional* treatment, by the influence of iodide of potassium, cinchona bark, cascarilla, or other tonics, will aid these local measures.

SUPPURATION AND ABSCESS, in the interior of a joint, should be treated promptly, by evacuation of the matter. The presence of pus

all resources and supporting regimen requisite to sustain the on of hectic.

Chronic Rheumatic Synovitis, or Chronic Rheumatic Arthritis Deformans.—Chronic Rheumatic Synovitis differs from ordinary Chronic Synovitis in certain particulars as to its pathological treatment, which are, however, worthy of separate notice. The disease may be generally described, as destructive—by absorption; and reparative—by osseous formation; resulting in a strange conjunction of *phy with atrophy*. (1.) The inflammation of the *synovial membrane* tends to affect the *vascular fringe-like processes* of this membrane particularly, which are much developed and injected; the internal surface of the capsule presenting the appearance of a villous mucous membrane. Effusion of serum, with some fibrin, into the joint takes place in a moderate amount, and is eventually absorbed. But the *synovial membrane* itself remains *thickened and fibrous*; while osteophytes or *deposits* frequently form partly in its substance, principally around the *articular ends*, connected with the *periosteum* and *articular ends* of the bones. These osseous formations are nodular, and have a denser or more compact texture; unlike the long and spiculated, stalactitic osteophytes, and of a more cancellated structure, which results from either periosteal inflammation. Hence the term *nodosity* of the joints. The ligaments become relaxed, or partially destroyed. (2.) The *articular cartilages* undergo peculiar changes; becoming *fibrous* or perhaps *ossified* in parts, taking a yellowish hue, nodular, and then rough, ultimately being *eroded*, and presenting patches of ivory-like bony material or porcelaneous white, smooth, and glistening,—*eburnation*. This acquires even a *polished* surface under the attrition of the surfaces, and *linear furrows* are formed in the directions of friction by the movements of the joint. The articular ligaments and fibro-cartilages are more or less destroyed or *absorbed*; thus, the round ligament in the hip-joint, and the long biceps in the shoulder-joint, are removed by absorption. (3.) The *fibro-cartilaginous osseous* structure is much *condensed*, or, when *eroded* of cartilage, often acquires a porous character; the whole *articular end* of the bone is enlarged and deformed by the surrounding *osseous growths*; while the *articular surfaces* become singularly altered in texture. Thus, the globular heads of the femur and humerus are *enlarged and expanded*, and their necks shortened; the corresponding *articular cavities* also being enlarged and shallow. These alterations, the bony buttresses thrown out around the articular ends, have often been mistaken for fracture with bony union, in examining pathological specimens of the neck of the femur or humerus. The exostosis of the knee-joint resembles chronic rheumatic arthritis, in an advanced stage of this disease; but the exostoses are *capped* with *cartilage*, and thus differ from the purely ossific deposits consequent on chronic arthritis.

Signs of chronic rheumatic synovitis or arthritis are distinctive: the joint, with *stiffness or rigidity*, and *limited movements*, especially in flexion and rotation, with *wasting* of the disused muscles; these symptoms are followed by enlargement and ultimate *nodularity* of the joint, and a peculiar *grating or crackling* sensation—noise, on moving the articulation,—arising apparently from

rheumatic fever or from repeated attacks of rheumatism; or in a predisposed, direct exposure of a joint to cold or some slight injury or sprain, may evoke the disease. Many joints are liable to be affected; disease passing from joint to joint without relieving those originally attacked; or only one joint may be affected. The larger joints, especially the hip and knee, seem to be most frequently attacked in male persons, as those of the fingers, in females. But, apart from the relative difference, both sexes would seem to be nearly equally liable to the disease. Age has no special proclivity; the disease usually appearing after mid life, but it may also appear in young persons. Thin, delicate, and chilly persons are more often subject to chronic rheumatic arthritis than the robust; the social condition is exempt; the poorly fed and hard-worked being the more liable; the luxurious and indolent subject, to this disease; in the latter assuming the character of *rheumatic gout*.

COURSE AND TERMINATIONS.—Chronic rheumatic synovitis is insidiously persistent, evincing little tendency to subsidence, or termination in resolution. The irregular enlargement and deformity of the joints, the weakened state of the ligamentous structures, and altered condition of the articular surfaces, predispose to *partial dislocations* and *contractures* of the limbs; leaving the patient stiffened and crippled in his movements, and ultimately reduce him to a helpless condition. Loose cartilages, moreover, are apt to form in the joints. Suppuration rarely, if ever, occurs; the disease—apart from any temporary effusion of fluid—is essentially a *dry* disease of the joints. Anchylosis also is a rare termination, although the increasing articular rigidity, and wasting of the distal muscles, have an equivalent result. At last, the *general health* declines, and the patient becomes emaciated to a shadow.

TREATMENT.—*Preventive* measures, in the early stage of this disease, may succeed in averting its destructive consequences; but any measures for the removal of the osseous deposits or out-growths, or restoration of the disorganized state of the joints—in respect to ligaments, synovial membrane, and cartilages—will have scarcely any avail. *Local* treatment—in the early stage—is that of synovitis. *Rest* of the joint, and slight tonical depletion by a few leeches, may now

2. The *constitutional* treatment should be that of Rheumatism. In the early stage, bicarbonate of potash, in large doses, with wine of iron, may arrest the progress of the disease. Subsequently, iodide of potassium and sarsaparilla or guaiacum seem to have more controlling power. Tonics, in the form of quinine and iron, will often give effect where special treatment, by improving the circulation and nutrition, is defective in even apparently healthy subjects. Free action of the bowels must be promoted by warm clothing and sudorific medicines, as mustard powder and hot-air baths; while a rigorous attention to diet will be indispensable when the disease has a *gouty* character, with dyspeptic tendencies, denoting a constitutional origin of that kind. Nor should the hygienic treatment be disdained, when properly conducted. Mineral waters, coupled with a due observance of dietetic precautions, sometimes singularly beneficial in rendering joints supple and restoring the general health, at least for a time. The waters of Bath or Buxton in this country, Vichy, Wiesbaden, Carlsbad, Ems, or Aix-la-Chapelle on the Continent, are thus hopeful resorts for the victims of chronic rheumatism; and such patients should, if possible, winter abroad, out of the depressing and variable atmosphere of this country, in the genial climate of some of the other parts of Italy, or the south of France.

Ataxic or Tabetic Arthropathy.—Charcot's Disease.—In this peculiar disease, the STRUCTURAL CONDITIONS are peculiar. The Joints undergo *atrophic* changes, but *without* any accompanying *nodular* production of *new bone* or the stalactitic formations from inflammatory action, as in *gouty* or *osteo-arthritic* arthritis. The Bones are similarly affected. This osseous disease is characterized principally by enlargement of the Haversian

canals in the *Joints*, the articular ends are eroded and wasted, so that the bone is destroyed. Thus, in the hip-joint, the head of the femur is worn down and wasted to a stunted nodule, or may ultimately fracture; and the acetabulum becomes enlarged and shallow. Both the articular surfaces are denuded of cartilage, and present a worm-eaten appearance. Eventually, the remnant femoral head forming a prominence above on the dorsum ilii. Several joints are commonly affected in the lower extremities: as the knee, shoulder, and even the articulation of the jaw; and on both sides of the body, although not symmetrically.

The *atrophy* of the *Bones* predisposes to *fracture*; and here the reparation may occur is attended with the formation of external *callus*, to an *exuberant* extent. Thus, adjoining the hip-disease, fracture of the femur contrasts in the abundant production of new bone.

These arthritic and other changes are typically illustrated in the case of a woman, which was exhibited at the International Medical Congress (1881), and was afterwards presented by Professor Charcot to the Museum of St. Thomas's Hospital.

In connection with the alterations in the skeleton which constitute this disease, the *spinal cord*, as the seat of the ataxic disease, is found to have undergone *posterior sclerosis*.

The usual *symptoms* of *locomotor ataxy* precede and attend the disease in the joints and bones. Commencing insidiously and progressing slowly for years, there are the ordinary gastric attacks, and *girdle-pains* in the limbs, with *girdle-pains* around the waist, and loss

affecting only the membrane reflected over the ligaments, or cartilages. The articular cavity becomes diminished as the *pulping* of the membrane encroaches on the joint; and this taking place freely in the loose synovial folds which surround the cartilages, often concealed by the new formation. The circumferential synovial proliferate, in the shape of *red spongy granulations*, overspreads the cartilage, and to which this fleshy layer becomes firmly adherent by roots or processes entering the substance of the cartilage. A pulpy material forms in the areolar texture around the *outer* surface of the membrane, which thus becomes infiltrated and condensed. This gelatinous material apparently results from a failure in the normal development of the products of inflammation; in acute and chronic synovitis, a fibrous or areolar tissue being produced; whereas in a chronic inflammation, development does not advance beyond the first crude cell-structure.

The *knee-joint* is most commonly affected; less often, the hip-joint, the ankle or elbow; rarely the shoulder-joint. In adults, the joints of the foot, or of the wrist, are more often affected.

SIGNS.—1. In an *early* stage a sense of stiffness of the joint is experienced, and *tumefaction* appears, on either side of the patella; beginning imperceptibly, but slowly and gradually increasing; with *absence* of pain, even on moving the joint. The child walks with a *limping* or *lameness*. These early symptoms are not very characteristic. 2. In an *advanced* stage, after the lapse of a few months, a very considerable *enlargement* is presented, generally of an *irregular shape*, *colorless*, and *elastic*, without any distinct fluctuation. 3. The joint has not become tender on pressure, especially in the spots already indicated, describing simple synovitis; the articulation is *painful* when in the *limb* more or less *bent* and *fixed*. 4. *Rapid wasting* ensues, especially the extensor muscles more particularly; the *flexors* being contracted into a *cord-like rigidity*, in contrast with the flaccid and sunken from disuse. The *enlarged knee* thus becomes more prominent.

COURSE AND TERMINATIONS.—(1.) As the disease progresses, the *ages* undergo *ulceration* in *spots*, where the spongy processes are *loded*; though these spots are not, necessarily, at first, in direct contact with the pulpy synovial membrane. *Starting pains* set in, with the *iodic* action of the muscles, especially during sleep, awaking the patient to agony. The *articular surfaces* denuded of cartilage grate with a painful *crepitus*, when the joint is moved, unless only one opposed surface be destroyed, or the bone-ends have become covered with granular tissue. (2.) *Abscess* forms within the joint, or in the substance of the synovial membrane; and making its way to the surface, opens by various natural apertures. The ligaments yielding under the progressive destruction of the articulation, the joint is found to be unnaturally movable, and a *dislocation* often takes place in the direction of the flexed malposition of the limb. *Hectic* supervenes.

TREATMENT.—Remedial measures must have regard to the *constitutional* condition, and hence the treatment of Scrofula is here appropriate. The treatment consists in *absolute rest* of the joint, and the observance of a *suitable position* in the event of ankylosis. Hence, the use of a properly adapted splint may be, or become, necessary. A starched bandage, or other immovable apparatus, will enable the patient to get up for the improvement of his general health, but has the disadvantage of precluding the application of topical measures. Counter-irritation should be applied cautiously, by means of iodine paint, or occasional blistering. When the swelling is reduced to a passive state, *Scott's Emulsion* may be used as a means of counter-irritation, and the plaster of Paris will be more support. Friction and gradual motion will then finish off the disease, and restore the use of the joint.

Ulceration of the *articular cartilages*, with *abscess* and destruction of the joint, may be followed by *ankylosis*, and a useful limb, under continued treatment by rest and position, or *antiseptic opening* of the abscess; the destructive result of scrofulous synovitis will more probably necessitate the removal of the diseased part, either by *excision* or *amputation*.

The latter operation may be sometimes imperative, owing to the constitutional exhaustion rather than the extent of the disease. Loss of life will then be alternative to the loss of life; the patient, otherwise, usually sinking under prolonged hectic.

Scrofulous Disease of the Joints, or scrofulous inflammation and destruction of the cancellated structure of the articular ends of Bone.—A disease of a *chronic* character.—The alterations of the cancellous structure in this form of disease may be summed up as inflammation and consequent caries; arising only from ordinary inflammation of bone in the nature of the process associated with the disintegrative transformation. At first, the *cancellous structure* is simply more *vascular* than natural, then it becomes *softened* and *porous*; while the cancelli are filled with a *reddish viscid fluid*, and ultimately an opaque, friable, *tuberculous* matter. It appears frequently in separate points of the cancellous tissue, which, usually extending, coalesce.

This disease is commonly situated in the *articular ends* of the long bones; particularly the head of the femur, in scrofulous disease of the joint; in the head of the tibia or lower articular end of the femur, in the disease of the *knee-joint*; in the bones of the *tarsus*; in those of

as of the foot in disease of the knee disease progresses. 2. At length a *swelling* the joint, arising from infiltration of lymph. A puffy, elastic swelling of *globular* shape, while the skin retains "white swelling" formerly recognized becomes more conspicuous and appears to *gradual wasting* of the muscles and Scrofulous enlargement of the knee-joint in its characters from the swelling of the first instance, and for a considerable either disease, the limb becomes somewhat prevailing in that direction. The gait is undisturbed up to this period.

COURSE AND TERMINATIONS.—Scrofulous disease leaving only some oedematous swelling disease *progresses*, both to the *surface* and to the *bone*.

(1.) In the one direction, as the disease progresses, *suppuration* takes place and the bone is detached, leading down to worm-eaten caries and discharge. The textures are undermined in various tortuous ways, according to the direction of the disease. Towards the *joint*, as caries extends, depending on the osteal vessels, becoming loose, the bone is loosened, and they acquire a peculiar form. The ulceration commences usually on the *deep* or *osseous* surface, and disintegration equivalent to the caries of the bone. The cartilage may be detached and lie loose. The ulceration assumes a peculiar form, and is attended by *ulceration*; there being several pits on the articular surfaces, and which correspond to the *ulceration*.

cess of the disease, and give way; the *abscess* within the joint *bursts* through the synovial membrane, and at length finds its way to the surface, with sinuous openings around the joint. The head of the bone, altered in size and shape, and no longer restrained by ligamentous connections, undergoes *dislocation*, in whatever direction the disease may take displacement, and subject to the action of the muscles.

The joint has now become irreparably disorganized; but *anchylosis* may take place without dislocation, or an imperfect *joint* form after curation, the bone remaining in its new locality. Either of these alternative terminations, in the course of nature, are rare.

Constitutional disturbance of the most severe kind accompanies the destructive course of this disease; and the patient probably sinks gradually from long-continued pain and sleeplessness, purulent discharges, and the night sweats of *hectic*.

The concurrence of scrofulous disease in other organs than the joints must not be overlooked in our *prognosis*. Thus, the lungs or mesenteric glands may be affected with tubercular deposit; or tubercular meningitis, with effusion into the ventricles of the brain. And the social state of the individual should be taken into account; scrofulous disease arising and progressing far more readily in the poor and needy, than in the affluent classes of society.

TREATMENT.—*Local* appliances are of subordinate importance to *constitutional* treatment, yet they are co-operative in arresting scrofulous disease and the reparation of its destructive consequences.

In the first place, absolute *rest* of the limb is an essential condition throughout this disease; in the *earliest* stage to arrest its progress, and frequently to relieve pain and induce anchylosis. Due regard should be had to the *position* most favourable for the future use of the limb, in the event of this issue. Such rest, and position, can only be secured by means of a suitable splint. A leather or gutta-percha splint applied to the joint answers best, generally. But the *splint* must be of sufficient length to fix the limb entirely, and check any contraction of muscles which would affect the joint. Thus, in scrofulous disease of the *hip-joint*, a gutta-percha splint should be applied so as to embrace the side of the pelvis and two-thirds of the circumference of the thigh, extend from the short ribs to below the knee. The limb should be held in line with the trunk, or bent only *slightly* forwards. For the *knee-joint*, two lateral splints are preferable; supporting two-thirds of its circumference, and extending from the middle of the thigh to the middle of the leg. A *slightly* flexed position will be the most convenient in the event of anchylosis. For the *ankle*, also, two lateral splints may be applied to include the lower part of the leg and the sole of the foot; the patient being allowed to walk about with the knee supported by a sound leg. Disease of the bones of the *foot* will require the support of a flint moulded to the sole, and turned round the inner and outer side. For this, a large cloth boot may be worn, whereby the patient can walk about without injury to the diseased joints. In the upper extremity, scrofulous disease of the joints must be treated on a similar principle as rest and position. For the *shoulder*, a splint should be moulded to the joint, and extend down the arm to the elbow; the forearm being supported in a sling from the neck. A diseased *elbow-joint* is best

its operation, may be advantageously resorted to. For the *hip-joint*, a long splint, interrupted, with weight-extension from the foot, as in the treatment of fracture of the thigh. The *knee-joint* is, perhaps, best managed by a pulley sling-apparatus which encloses the limb in a trough; while slight extension is maintained by the inclined direction of the pulleys. This apparatus—applicable also to fracture of the arm or leg—gives great ease and comfort in advanced disease of the joint.

Thomas's splint is an excellent appliance for keeping the knee at rest, without extension; the weight of the body being borne on a crutch of the perinæum. The patient is thus enabled to stand, as usual—about—to the great benefit of his general health—without any of the articular surfaces.

Other local treatment—from first to last—may be regarded comparatively unimportant. Scrofulous disease of a joint cannot be cured by any depletory measures, and in proportion as they reduce the vitality of the health such measures are positively injurious. *Local blood-letting*, by a few leeches, may sometimes prove beneficial in the incipient or early stage of the disease. But the repeated loss of blood would be injurious. *Counter-irritation*, by blisters, setons, etc., has an equally remote applicability. The discharge and pain they occasion more than balance any good resulting from their *derivative* action, especially in children. If the disease subsides, with oedematous swelling, *stimulating* applications have some beneficial influence. Hence, embrocations, liniment, paint, and douches of sea-water, are now useful. *Pressure* also—by a starched bandage, or pressure with stimulation—by Scott's strapping—may be applied with advantage.

Abscess having formed *around* the joint—in the course of the disease—a free and dependent *opening* should be made in time to prevent bursting of the matter. The starched bandage can still be used, with an opening opposite the abscess, for the convenience of dressing and

be varied from time to time, and with occasional intermissions. For children, the *vinum ferri* seems preferable, and after a while the syrup of the iodide of iron may be given in exchange; these and other simple preparations of iron being continued for three or four weeks, and then omitted for a week or ten days. But this course of treatment must be extended over a considerable period, probably two or three years.

ACUTE ARTICULAR OSTEITIS, OR EPIPHYSITIS—so named when occurring in a young subject—presents similar appearances to those of acute inflammation as affecting the shaft of a long bone. Acute Osteitis in one or both the articular ends, and in the shaft of a long bone, are not unfrequently associated, as an *extension* of the inflammatory affection from the seat of origin; more often from the shaft to the articular ends, or epiphyses. When the latter situation is the *primary* seat of inflammation, the neighbouring joint almost always becomes involved; synovitis being consequent on the epiphysitis.

Anchylolysis, or Stiff Joint.—Two states of anchylolysis are recognized: the *Fibrous* or incomplete, and the *Osseous* or complete. Both signify the junction or union of the *articular* surfaces of the *bones*, thus presupposing the partial or complete removal of the articular cartilages; unless occasionally, in fibrous anchylolysis, where bands of false membrane may be thrown across the synovial capsule, forming adhesions, or the natural folds of the synovial membrane may have become adherent, with some stiffness of the joint. Either condition of anchylolysis may be *extra-capsular*; the fibrous consisting of a thickened and indurated state, or perhaps cicatricial contraction, of the ligamentous capsule, with adhesions around the joint; and osseous anchylolysis externally, being the formation of new bone around, and on the articular surfaces of, the joint. Besides these conditions, a species of anchylolysis or stiff joint may depend on *partial dislocation*, from destructive disease of the joint, or an unreduced partial displacement by injury. A *contracted* state of the *muscles*, or of a *cicatrix*, acting on a joint, may also produce stiffness in the movement of the articulation,—not, properly speaking, an anchylolysis.

(1.) *Fibrous* anchylolysis is liable to happen to any joint; and the shortened and contracted state of the muscles acting on the joint gives an apparent firmness to the anchylolysis, beyond that due to the joint-condition; a portion of the articulation generally remaining sound.

(2.) *Osseous* anchylolysis occurs most commonly in the hip, knee, or elbow; the articular surfaces seeming to be fused together, as seen more clearly on a vertical section of the bones.

SIGNS.—Both states of anchylolysis are attended with a proportionate loss of mobility in the joint; the *fibrous* allows of some degree of motion, more so, perhaps, under chloroform; the *osseous* presents a perfectly rigid and immovable joint.

Firm adhesions, short and extensive, may simulate osseous anchylolysis. The probability of fibrous anchylolysis having taken place will then depend on the *pain* produced by any movement of the joint which stretches the fibrous union, on the flexion aspect of the articulation, by extension, or on the extension side, when the joint is flexed. *Spasmodic twitching* of the opposed muscles is also elicited by some degree of mobility.

Both anchylolyses are accompanied with more or less *deformity* of the *limb*, arising from malposition of the bones obediently to muscular con-

surfaces, the movement of the fibrous bond is attended resistance and a *gradual check*; whereas, with *periarticular* movement of the joint, however restricted in extent, is so far arrested by a more *abrupt catch* of the tightened ligamentous ossific deposit.

Muscular contraction, as a cause of apparent ankylosis overcome by conducting the examination under the influence of anesthesia; and the passive state of the muscles will enable to eliminate a source of error in his diagnosis of any ankylosis.

The CAUSES of Ankylosis have reference to inflammatory diseases of the joints; synovitis, or caries. Destruction of the cartilage case, may be succeeded by *reparation*, in the form of ankylosis; the fibrous state represents the incomplete result of reparation; its completion, by the transformation of the fibrous into bone.

TREATMENT.—*Preventive* measures consist in the prompt treatment of the diseases leading to ankylosis; while the treatment should also be taken of securing the limb in such *position* most useful in the event of this result.

Remedial treatment consists in restoring, if possible, the motion of the joint, and correcting any deformity of the limb. Or the correction of the deformity may be the main object in view.

Fibrous ankylosis—admitting of some motion in the joint, it commonly yields to passive motion, from time to time; thereby regaining the use of the joint. Firmer union will probably be overcome by *extension*; either *gradually* applied by means of a mechanical apparatus, or by *forcible* manipulation, in the way of flexion and extension, under the influence of chloroform. 1. The form of treatment is painful, and liable to induce inflammation, and is of long duration, having to be continued for a period of from one to three months, according to the resistance of the ankylosis, and the size of the joint.

the application of a properly adjusted *retentive instrument* or passive motion also being practised occasionally. Extension will generally prove sufficient, but any resisting tendons may subcutaneously, *tenotomy* completing the cure. In such case, the splint should be so adapted that, according to the rule of the after-treatment of tenotomy, the limb shall remain at the angle in which it was prior to division of the tendons, until they have healed—about the fourth day; when extension may be resumed. The knee, hip, or elbow joints, for example, can thus be brought to a fair degree of mobility, and the limb brought to a good use. A too sudden or instantaneous, as well as forcible flexion and extension of a fibrous ankylosis, is liable to be attended with severe results, either by fracture of the articular ends of bone, dislocation, or rupture of the adjoining blood-vessels and nerves; or it may be followed by inflammation, suppuration, gangrene, or pyæmia. When these results occur, or manipulative and perhaps operative procedures have failed, the use of a fibrous ankylosis be incompatible with a good use of the limb, the use of such ankylosis of the knee-joint, *excision* of the joint is advantageously resorted to; and the more so, in proportion to the extent of the limb.

As ankylosis cannot be overcome by any justifiable force of

But the propriety of operative interference will depend on the extent and utility of the limb; whether owing to the kind of ankylosis, or to the elbow-joint, or malposition of the limb, as may be the case in the knee-joint. 1. *Subcutaneous section or drilling* of the joint consists simply in making a small puncture or incision at the junction of the articular cartilages, and the introduction of a sharp-cutting gouge, or a gouge-drill, which is driven between the bones in different directions, so as to weaken their connection, and the limb to be straightened by gentle manual extension, aided by tenotomy of the hamstring muscles. 2. *Subcutaneous section* in the vicinity of an ankylosed joint, offers another resource, with regard to the *hip-joint*; as in Mr. W. Adam's operation—by section of the neck of the femur, subcutaneously; Dr. Rhea-Barton's and Mr. Adams's operations—by section through the trochanters; or the operation which I proposed—section of the femur just below the trochanter—a *trochanteric osteotomy*. A similar operation has since been performed in the *knee-joint*; Volckmann having divided the femur just above the condyles, followed by Mr. Barwell, in this country. Section of the tibia and fibula, just below the joint, may be advantageously coupled with supra-section, for extreme angular deformity; thus to halve the extent of the adjustment of the bones. The elbow has been submitted to in like manner—by supra-condyloid section of the humerus. When ankylosis becomes justifiable after subcutaneous division has failed, the operation would be inappropriate to correct malposition of

Thus, the removal of a wedge-shaped portion of bone, from an ankylosed joint, may be necessary to rectify an angular deformity of the limb, in the case of the *knee-joint*; a mode of excision proposed by Birch, of New York, and which I have practised with success. Dr. Rhea-Barton had previously proposed another mode of excision, under these circumstances—the removal of a wedge

of bone from just *above* the condyles of the femur, and not including their entire diameter; the remaining portion of bone is fractured by bending the limb backwards, so that the limb can be straightened. But the former angular position was retained a short time by means of a corresponding splint, and the limb gradually extended before the period for bony union. *Amputation* will be warranted only in the extreme case of a useless limb, and which cannot be rendered tolerably serviceable by excision.

Loose Cartilages in Joints.—Small movable bodies occasionally form within a joint, and which may be quite *free*, or *attached* by a pedicle to the walls of the articular cavity. One such body sometimes exists, but not uncommonly two or three, and possibly many. Varying in size from a barley-corn to a chestnut, they are roundish or flat, elongated or tuberosus. In consistence, colour, and structure, these may be soft and of a yellowish colour, like little *melon-seed* material, or *fibrin*; or hard, whitish, and glistening, consisting of *cartilage* or *bone*; or converted into bone. Neither the term "cartilage" nor "loose" is, therefore, universally applicable.

Any joint possibly may be the seat of these bodies; but they are usually in the *knee*, and less frequently in the elbow, shoulder, or jaw.

They seem to *arise* from the *vascular processes* of the synovial membrane, as out-growths of that membrane, projecting into the joint. These cartilaginous bodies form most frequently as the result of a chronic rheumatic synovitis; and more often in adults than at an earlier period of life. Billroth's observations point to the ligamentous capsule as the most frequent source of these ossifying cartilages, which may enter the joint, and become free. Rarely, they form in the synovial tufts. Several modes of origin seem probable in some cases. Thus, the fibrinous exudations may be remnant *blood-clots*; or, perhaps, represent exudations or precipitations from the synovia. Possibly, an *out-growth* from the articular cartilage, a *bit of cartilage*, or a *portion of bone* becoming detached from the articular surfaces, or resulting from ossific deposit, may give rise to similar symptoms.

SYMPTOMS.—It will be readily supposed that any such foreign body getting nipped in between the articular surfaces, must occasion remarkable symptoms. Hence, an *attached* cartilaginous body may be quiescent; a *detached*, or entirely loose cartilage, moving about in the synovial capsule, is more apt to slip in between the bones. Up to a certain time the patient may have experienced occasional twinges, as if of a rheumatic character; but now a *sudden, intense, and sickening pain* comes on; and the *joint* becoming *instantly locked*, the hitching or fixity of the limb may throw him to the ground in the progress of his disease. Sudden dislodgment of the intervening cartilage is capable of occurring, whereby the *joint* is *immediately restored* to its normal state of painless mobility; leaving only perhaps a little temporary stiffness. These symptoms having recurred at intervals, on the slightest motion, and sometimes during sleep, the sufferer seeks relief. On careful examination, a foreign body can usually be found, and by palpation it may be perhaps to a standstill at the edge of the patella—in the knee-joint there made to *bulge under the skin*; or the patient can, perhaps, feel

the movable body perceptible, by a jerking movement of the joint; the little smooth cartilage *easily slips away* from under the finger, and again disappears. Some such bodies having an *attached* pedicle, the movements will be *restricted*; but if always found in the *same place*, and *able of concealment*, the body is probably *not within* the joint.

The consistence of the substance will perhaps indicate its nature—whether it be cartilaginous or osseous. But the *diagnosis* must be made in any such body and the *overgrowth* of *synovial fringes*, or of *fat tufts*. Either of these formations may occur in the knee-joint. A hypertrophied fringe may be recognized by its yielding, on pressure to the bone, a soft rustling sensation—which Mr. Barwell aptly denominates the *silken crepitus*; and (2) a lipomatous growth has a very but somewhat *elastic* consistence, as if a slug were *slipping* in the thumb and finger. (3) Sometimes, *fibro-cartilaginous plates* in the synovial capsule; and any body so located, may be dislodged from a false cartilage within the joint, by the thickness of the bone, and its yielding with firmer elastic resistance than usual; while a *cartilaginous area* can be *depressed*, but has *no lateral mobility*. Removal of an inter-articular cartilage is attended with similar symptoms; sudden and intense pain, with locking of the joint. The diagnosis must be uncertain.

Ultimately, the joint itself sometimes becomes diseased; prolonged inflammation inducing *synovitis*, with relaxation of the ligaments, which are aided also by having been stretched by the repeated interposition of cartilage between the articular surfaces.

TREATMENT.—Recurrence of the attacks of pain may be prevented by fixing the motions of the joint; thus fixing the loose cartilage temporarily or perchance permanently. Hence, an elastic bandage or *kneecap* should be constantly worn. Often the relief afforded is such that no further interference becomes requisite.

Removal of the foreign body is the only other resource; but this should never be lightly entertained, considering the risk to the joint, and to life, contingent on the operation of extraction—and although the strict antiseptic precautions be adopted. It is justifiable only when the cartilaginous body is *loose*, and *freely movable*, of some *size*, and *entirely single*. Taking a favourable opportunity—after the pain and inflammation of an attack have subsided—this operation may be performed, in three ways.

The cartilage must first be carefully fixed, in a steady spot, with the middle finger and thumb. In the knee, it may be made to project on the side of the patella. The skin is then to be drawn to one side, and incision made *directly* down upon the cartilage, which is then allowed to *escape*. On relaxing the skin, the valvular aperture is at once closed with fine sutures, and the limb should be kept at rest on a splint until the symptoms of synovitis have subsided.

Another mode of operation consists in introducing a tenotomy-knife *deeply* underneath the skin, and dividing the synovial capsule upon the *exposed* cartilaginous body; then, squeezing it through the synovial opening into the external cellular texture, where it is allowed to *remain*, the integumental aperture is closed with fine sutures. If the cartilage should not become absorbed, it is extracted from its bed by a *sub-*

cutaneous incision, when the synovial aperture has healed, after the lapse of some days.

3. Mr. Syme recommends yet another method, by which, he says, he generally succeeds without risk. It consists in "making a free sub-cutaneous incision through the synovial membrane and cartilage, and applying a blister over the part where it is retained."

In attempting to remove a false cartilage by any of these procedures, the Surgeon may be defeated; when the body, having an attached pedicle, is not entirely loose; or if free, it may slip away again and again, and at last getting concealed in a synovial fold or a cul-de-sac, thus elude extraction.

CHAPTER XXXIII.

DISEASES OF PARTICULAR JOINTS.

Diseases of the Hip-Joint.—The hip-joint is liable to the same inflammatory diseases as other joints, affecting its component structures: synovitis, scrofulous caries, and ulceration of the articular cartilages. The second-named disease presents characters worthy of a separate description.

Scrofulous Disease of the Hip, or Morbus Coxarius.—This disease commences in the *cancellous tissue* of the head of the femur, or of the *acetabulum*; possibly, in both bones simultaneously. It may also commence in the synovial membrane, as scrofulous *synovitis*; or, perhaps, in the round ligament.

The name *scrofulous disease of the hip-joint* is used as a general term including these different *seats of origin*. But there are cases in which the disease is not apparently a scrofulous affection; the caries or the synovial inflammation being of a simple character, and arising in a healthy constitution, only from some external cause, as injury or exposure to cold.

In scrofulous caries of the hip, the cancellous tissue undergoes the structural alterations described in connection with this disease of Bone; briefly, increased vascularity, softening, deposition of a reddish fluid in the enlarged cancelli, followed by a yellowish opaque tubercular matter.

Subsequent structural alterations are as follows:—The *articular cartilages* become involved and disappear, more or less completely; and abscess forms within the cavity of the joint. The affected portions of bone become remarkably changed in shape and size. The *head* of the femur—bared, perhaps, of cartilage, and the open cancellous tissue exposed—is flattened and expanded, mushroom-like in form on the neck of the bone; and the *neck* itself, sharing in the disease, may be so reduced as to leave nothing more than a slight nodular vestige, if any remnant, of the diseased bone projecting from the great trochanter. This portion of the bone, and the adjoining portion of the shaft, are not unfrequently carious; either by an extension of the joint-disease, or as the original seat of caries. The *acetabular cavity*, also denuded of cartilage, is enlarged in circum-

is, but shallow; the cotyloid ligament and bony rim of this cavity have been destroyed. The *round ligament* may have disappeared, and the *psular ligament* at length giving way, the abscess bursts into the surrounding cellular texture. Thus, the joint is utterly destroyed.

TERMINATIONS.—(1.) *Anchylosis* rarely takes place, as a mode of termination. (2.) The remnant of the articular end of the femur is drawn into the action of the muscles into the patulous acetabulum. Thence the femur has even been forced through the thin carious bottom of this cavity, and entered the pelvis. (3.) But the ill-fitting, loose articulation, in advanced disease, is most liable to *dislocation*. The femur, drawn upwards and outwards by the glutei muscles, passes over the reduced rim of the acetabular cavity, and slipping on to the *dorsum illi*, lodges there.

More rarely, the femur is thrust out of the acetabulum forwards, and rests on the *ramus* of the *pubes*.

The abscess finds its way to the surface by burrowing sinuous tracks, and in various situations. The *openings* relate somewhat to the *seat* of the disease. When it originates in the *head* of the femur, the sinus opens some way down the thigh, and opens probably near the insertion of the tensor vaginae femoris muscle. *Acetabular* abscess presents a sinus-opening in the gluteal region, near the anterior inferior spine of the ilium.

Matter may also pass down by the rectum, bursting into it, or close to the anus. If the pelvic bones be involved, a sinus-opening is situated in the pubic region, above or below Pott's ligament; above the ligament, it leads usually to *intra-pelvic* abscess; below the ligament, to disease of the rami of the *pubis* or *ischium*.

Symptoms.—(1.) Scrofulous disease of the hip approaches and progresses very insidiously, commencing generally in early life, under the age of puberty, scarcely any pain—but what the mother will call “growing pain”—is complained of in the first instance, or for weeks, or months, as the disease slowly progresses. The first perceptible sign is a *slight limp* in walking—the child shuffling, hobbling, or dragging the leg, step by step. This lameness is aggravated by exercise, but temporarily disappears at rest. 2. Some *fixity* of the hip-joint may be detected; in putting the limb through various movements, as of flexion and extension—the pelvis moves with the thigh,—the patient lying recumbent. 3. When standing, the weight of the body is thrown on the other limb to relieve the halting member. This attitude is peculiar; the hip of the sound limb being elevated, gives an *obliquity* to the pelvis downwards and forwards on the *diseased* side; the thigh is

FIG. 45.*



peculiar; the hip of the sound limb being elevated, gives an *obliquity* to the pelvis downwards and forwards on the *diseased* side; the thigh is

Royal Free Hospital. From a boy, aged sixteen. Disease of about six months' duration. (Author.)

slightly bent on the pelvis, and the leg on the thigh, the toes touch the ground. The *limb* may be somewhat *abducted* and *everted*, the being turned outwards, and in advance of the other side. 4. But in the *first stage* of diseased hip-joint, the limb is *apparently elongated* (Fig. 1). This, however, is a deceptive appearance, arising from the obliquity of the pelvis downwards towards the diseased hip; measurement with tape from the anterior superior spine of the ilium to another fixed point below the joint, the inner malleolus, will at once show that there is no elongation in reality. The pelvic obliquity, and apparent lengthening of the limb, will be shown by placing the body as straight as possible on the limbs; then drawing a line, with tape, across the pelvis, between two anterior superior iliac spines, the *angle* of this line to the *middle* of the trunk, on the diseased side, indicates the inclination of the pelvis downwards; the greater the obliquity, the less or more acute is the angle. If the transverse line be drawn across at right angles to the vertical, the distance above the anterior superior spine on the diseased side will measure the *amount* of pelvic obliquity. 5. The limb becomes useless from disuse, the gluteal muscles especially, so that the buttock is flat and flaccid, wider than natural, and the lower fold of the nates is marked, while the line between the nates curves towards the diseased side. 6. *Pain* is now felt in the hip, or referred more to the *inner* side of the *knee*; and the pain in the former situation is aggravated by attempt to bear on the joint, by *abduction* or *rotation* of the limb, especially by concussion of the bones, as by striking the trochanter, jerking the limb upwards from the sole of the foot. Pressure also on the trochanter increases the knee-pain; but there is no tenderness at the knee, nor does pressure there increase the hip-pain. Pain on the outer aspect of the knee is a *sympathetic sensation*; depending, probably, on the nervous relation between the hip and knee, through the obturator and perhaps the anterior crural nerves. Both these nerves supply articular branches to the hip, and to the inner side of the knee. A *deeper* pain in the knee is probably sympathetic of disease of the femoral head, or may be directly transmitted through the shaft; and this osseous pain in the knee may thus be diagnostic of disease commencing in the head of the femur, rather than in the capsule, to which the articular branch of the obturator nerve is distributed,—the articular branch to the knee is also distributed to the synovial membrane. Sometimes, less fixed pain is referred to the thigh, in front and its inner side; or to the buttock, at the anterior superior spine of the ilium.

(2.) *Real shortening* of the limb—succeeding its apparent lengthening—marks the *second stage*, as it has been termed, of this disease, and coincides with advancement of the disease to *destruction* of the cartilage and of the head of the femur, acetabulum, or both bones; whereupon the limb is drawn up by muscular action. Shortening varies, therefore, in different cases, but it increases as the disease progresses. The attitude of the limb is somewhat changed; still remaining flexed, it has now become *inverted* and *adducted*, with projection of the *buttock* back and upwards, tilting the pelvis downwards and forwards on the opposite or *healthy* side. Some *apparent* shortening of the limb is produced by this uprising of the buttock. The lateral inclination of the pelvis produces a compensatory *lateral curvature* of the *spine*, in

lumbar region—the convexity of the curve being to the healthy side; with more or less *incurvation* or *lordosis*, owing to the uprising of the buttock backwards. In the recumbent position, this incurvation may be made to disappear, or be reproduced, by flexing or straightening the thigh; the lumbar arch falling when the thigh is bent forwards, and rising again as the limb is straightened. Wasting of the limb increases, as the disease progresses. This shortened, flexed, inverted, adducted, and wasted limb, with obliquity of the pelvis and twisted lordosis of the spine, presents a very characteristic appearance (Fig. 46). Pain also has become more severe, and aggravated by the attrition of the exposed surfaces of bone, subject to spasmodic muscular action, has acquired the character of *starting pains*.

FIG. 46.*



Abscess within the joint bursts into the surrounding cellular texture, and forms a swelling in connection with the hip, which up to this time has undergone no further alteration than a slight fulness in the groin, and enlargement of the inguinal glands. *Abscess*-swelling is rendered more conspicuous by the wasting of the thigh and buttock. When, at length, the abscess opens externally, the situation of the *sinus-apertures* denotes, as already indicated, the probable seat of the disease; whether in the head of the femur or acetabulum.

Dislocation is very apt to supervene, commonly on the dorsum ilii; yet, although attended with *increased shortening*, the attitude of the limb, flexed and inverted, remains the same; the obliquity of the pelvis, however, beginning to subside, and the pain being greatly relieved. The *extent* of shortening will not determine the presence of dislocation; it being impossible to apportion the amount due relatively to pelvic obliquity or posture, and to bone-absorption. Nélaton's line, between the anterior superior iliac spine and the tuber ischii, will show whether the trochanter has risen above, and to what extent; but the altered relations of the articular surfaces, from disease, renders this test inaccurate. But the *head* of the femur or its remnant, with the great trochanter, can be *felt* in its new situation, on the back of the ilium; and often very distinctly, the gluteal muscles having wasted so much that the bone seems to lie immediately under the skin. The additional symptoms—wasting of the limb, and sinuses discharging an unhealthy pus and leading down to diseased bone—complete the local diagnostic differences of appearance from *traumatic* dislocation. The *general health* also has now become worn down by irritation and hectic; and this constitutional condition, coupled with that of the diseased limb, form a picture which leaves little or no doubt as to the nature of the case, not to mention the previous history of its insidious origin. In the *young* subject, and as a rare occurrence, separation of the epiphysial cap of the femoral head may simulate dislocation. But the shortening is even more marked, and

* Another case. (Author.)

accompanied with mobility, particularly downwards, so that the limb can be made of equal length with the other, without drawing down the pelvis.

DIAGNOSIS.—Scrofulous disease of the hip-joint is liable to be mistaken for other diseases, if *any one* particular symptom be alone considered.

As an *hysterical* affection, the pain has all the pronounced characters of *hysterical pain*. It is unusually severe or even excruciating; superficial, being elicited by the lightest touch rather than by deep pressure; more diffused, extending over the thigh and buttock, and not located in the hip or traceable in the course of the obturator nerve; it is inconstant—sometimes present, sometimes absent; or migratory to some other joint or part; or vanishing altogether. But the *pain is not provoked* by the movements of flexion, abduction, and rotation; nor by pressure or percussion of the heel or trochanter. At a later period, starting pains may be experienced, but they do not occur during the sleep, as in joint-disease, when the patient's will and attention are in abeyance. The *objective signs* of hip-joint disease are *occasionally present*: fixity of the thigh, the pelvis moving with it; apparent lengthening, with a flexed and perhaps abducted position of the limb, or apparent shortening, with flexion and adducted inversion; while the pelvic obliquity, with lumbar curvature and lordosis, may complete the picture of real disease. Muscular wasting of the buttock and of the thigh not unfrequently *ensues from disease*; but this aspect of the limb is unaccompanied with signs of joint-inflammation—swelling in the groin and behind the trochanter; or, as in a later stage, the super-vention of abscess. Lastly, the *general health* remains throughout comparatively unaffected.

Proceeding to the diagnosis of the various forms of structural disease or injury, for which hip-joint disease is perhaps liable to be mistaken, the *concurrence* of symptoms, and as compared with those of each of these diseases, will determine the diagnosis.

1. Thence the distinction of hip-joint disease from *dislocation* of the femur on the dorsum ilii. If the shortening, and the flexed and inverted attitude of the limb, as two signs of hip-joint disease, be taken alone, it might so far resemble dorsal dislocation, apart from the concurring sign of a *wasted appearance* of the limb, coupled with obliquity of the pelvis, and twisted lordosis of the lumbar spine, all of which signs are absent in dislocation on the dorsum ilii. When dislocation has taken place from disease, the additional signs of *abscess*, generally in the buttock, followed by *sinus-openings* in the situations already noticed, are diagnostic. The *history* of the case, as having the progressive character of disease, or as one of sudden violent injury, must always be further taken into account.

2. In young subjects, however—in whom disease of the hip-joint is more commonly met with—*congenital* dislocation of this joint is more likely to be the question of diagnosis. The joint is imperfectly developed; and the *loose gait* of the child attracts attention, the movements are painless, and the dislocation is *readily reduced*, but it *as easily returns*,—the small, stunted femoral head slipping in and out of the shallow, misshapen acetabulum, being unsecured by a round ligament, and not restrained by the large and incomplete capsule.

3. *Infantile paralysis*, with wasting and *defective growth* of the limb, will also be recognized as a peculiar affection, in relation to the differentiation of hip-joint disease.

4. *Sprain* of the hip-joint simulates disease of the joint so far as to be attended with a painful, limping lameness; the hip is raised and the limb flexed, perhaps everted; and in the course of time, there may be more or less wasting of the buttock and thigh; all these symptoms arising from the pain provoked by any attempt to use the limb, in standing or walking. But, while the pain is more acute than that which the patient complains of in the *early stage* of hip-joint disease, the *hip is raised*, as if the limb were shortened on the affected side; and in a *later stage* of sprain, the limb still retains its natural length,—there is *no real shortening*. Here, also, the antecedent *history* of an injury will enter into the Surgeon's consideration of the case, but as a less important factor; for a sprain might give rise to disease of the hip-joint.

5. *Interstitial absorption* of the neck of the femur might readily be mistaken for disease of the hip-joint. Arising from a fall on the trochanter, absorption of the neck of the bone proceeds slowly, and is attended with shortening of the limb. But the *inverted position*, seen in disease of the joint, is *wanting* to complete the resemblance.

6. *Rheumatism* of the hip-joint may be an acute or chronic affection. An *acute* attack of rheumatism will rarely settle in the hip-joint, as rheumatic synovitis, leaving other joints unaffected. The *co-existence*, therefore, of similar symptoms in other parts, will at once distinguish such an attack from scrofulous disease of the hip-joint. But the *intense* character of the *pain*, and tender, tense swelling in the groin, behind the great trochanter, or in both situations, are *unlike* the more passive state of the joint, in an *early stage* of *caries*. Chronic rheumatic arthritis, or synovitis, when limited to the hip-joint, certainly bears a general resemblance to scrofulous disease of the joint, in a more advanced stage. But here, again, the *character* of the *pain* is even more distinctive; an aching, boring, gnawing pain, increased by motion, yet wearing off somewhat by exercise during the day, worse at night, and aggravated by exposure to variable climatic changes of cold and moisture. The irregular enlargement or deformity of the joint, from *nodular ossific deposit*, may not be so palpable as in rheumatic arthritis of other joints, as the knee; but the peculiar *rigidity* or stiffness, and *crackling* or *grating* sound on moving the joint, can scarcely be overlooked in the examination. The patient's *age* will also be considered; although acute rheumatism may occur in childhood, chronic rheumatic arthritis is usually a disease of mid-life.

Disease of the hip-joint might be mistaken for disease of, or originating in, *other parts*, if the Surgeon's attention were directed exclusively to any one symptom.

1. Thus the pain in the inner side of the *knee* might be referred to disease of that joint; unless the *association* of the other symptoms or signs of hip-joint disease be observed, and the *absence* of the characteristic *swelling* of *synovitis*, or of *scrofulous caries*, as affecting the knee-joint. But the possible co-existence of disease in both hip and knee joints should not be forgotten as an occasional association. 2. *Lateral curvature* of the spine is attended with obliquity of the pelvis corresponding to the lumbar curve; the pelvis being raised on the side of concavity, and lowered from the opposite convexity. Yet there are *no other signs* of hip-joint disease. 3. *Psoas abscess* presents a swelling, often of considerable size, in the groin,—an exaggerated appearance of the fulness seen in disease of the hip-

joint. But this swelling can be *reduced* or returned into the abdomen by compression, aided by the recumbent position; and it has a *marked* increase when the patient coughs or makes any straining effort; in both respects differing from any inguinal fulness in connection with hip-disease. 4. Abscess *near* the hip-joint, but unconnected, may be extra-pelvic or pelvic; and in either case, the diagnosis may be determined by a thorough examination around the joint, and by rectal exploration, coupled with percussion through the abdominal wall. 5. *Enlargement* of the *bursa* under the psoas-iliac muscle forms a *swelling* in that situation, *distinct* from the swelling of the *sule*, when the two do not communicate; and the *movements* of the hip are free and painless, except when the muscle is stretched by extension and rotation outwards of the thigh. 6. More often, I think, there may be *enlargement* of the *bursa* over the *great trochanter*; the painful swelling in this case, being more plainly defined, and *limited* to the trochanter. 7. *Ostitis* or *osteitis* of the great trochanter resembles disease of the hip-joint, excepting in the more *superficial* seat of *pain*, and which is not aggravated by any *movement* of the joint itself, or by weight-bearing pressure, or concussion upwards from the sole of the foot, nor is there any sympathetic pain on the inner side of the *knee*. No *shortening* of the limb results, and a more *advanced* stage of hip-joint disease. Trochanteric disease *co-exists* with that of the joint no longer offers any ground for diagnosis; practically, no distinction is necessary.

TREATMENT.—The directions given with reference to scrofulous disease of the joints generally are here applicable, rendering any repetition of the same unnecessary. Absolute *rest* of the joint must be secured, and a position as favourable to the future use of the limb, in the event of ankylosis, as can be obtained. A *splint* moulded to the hip and extending below the knee, with the upper portion straightened, may answer this twofold purpose. In the second stage of disease, the *long, straight* splint, with *weight-extension* from the foot, may be applied with more advantage; thus to counteract muscular spasm, and prevent pain coincident with ulceration of the cartilages in contact, and the risk of dislocation as the disease advances. The weight should be proportioned to the muscular resistance,—weakened by wasting, but increased by spasmotic contraction. One pound to two or three will probably be sufficient. But the importance of keeping the trunk in a line with the limb, to correct malposition, will be obvious.

A very useful *splint* has been devised by Mr. Thomas, of Liverpool. It consists of a metallic bar-support, extending underneath the limb, from about the middle of the calf to the middle of the back, the leg and foot portion being straight, while the upper portion is bent to the form of the thorax and loins. This is fastened by straps across the thorax, and is secured by a shoulder-strap. When the limb is first placed in this *splint*, it may be allowed to remain bent, as from disease of the hip-joint; gradually it yields to moderately tight bandaging from below upwards, and subsides into a straight position. This splint possesses at least *two advantages*: it prevents any movement of the thigh upon the pelvis, and fixes the joint; and the whole trunk and limb form one piece, so that the patient can even be raised from the bed, without any disturbance of the joint. Both these conditions are very desirable, especially in young patients, and who are more frequently the subjects of hip-joint disease. In the treatment by means of Thomas's splint, weight-extension,

th on the diseased side, move together as a whole.

ankylosis should be prevented, if possible, by timely, judicious movements of the limb. In the event of a stiff joint, coupled with such shortening, and an adducted, inverted, and flexed state of the hip the patient will be proportionately crippled; but the lumbar spine and the other joints of the lower extremities acquire a considerable compensatory mobility, and in walking, progression is effected from that part, on the diseased

side. An incision should be opened to prevent burrowing of the matter among the muscles. The situation of pointing is selected, usually about an inch and behind the great trochanter. For the convenience of dressing, an "interrupted" splint may be used. The *general treatment*, medicinal and hygienic, consists in a course of iron, quinine, cod-liver oil, and a nutritious diet, with as much pure air as possible. I have very beneficially treated my hospital patients in bed in the quadrangle of the hospital, for several hours daily, weather permitting.

This plan of treatment must be pursued for a considerable period—weeks or months—to solicit ankylosis; or the subsidence of the abscess, possibly, after dislocation, and a free discharge of matter with the removal of the carious bone.

It is thus to bring the disease to a termination, and the *general treatment*, beginning to decline, operative interference becomes imperative. It will be considered under Excision of the Hip.

Chronic Rheumatic Synovitis or Arthritis.—Morbus Coxæ

CHRONIC.—This disease contrasts with scrofulous disease of the hip-joint, especially in the formation of osseous depositions or out-growths around the joint, and in the absence of suppuration.

SIGNS, AND DIAGNOSIS.—Commencing with stiffness and aching pains in the joint, both of which are somewhat relieved by exercise, at length *crepitation*, which can be both felt and heard when the joint is moved, affords characteristic evidence of the disease; coupled with its chronic character,—the absence of suppuration in the joint, and its consequences,—the swelling of abscess and the discharging sinuses which would be characteristic of a scrofulous disease. *Shortening* of the limb to some extent occurs,

lordosis, from backward uprising of the buttock—thus presenting an apparent shortening of the limb, even more than has taken place, to the extent perhaps of about an inch. (R. W. Smith.) How much this picture, consequent upon chronic rheumatic arthritis of the hip-joint, resembles that resulting from scrofulous disease, in its second stage, but for the position of the foot and limb—everted, not inverted.

The disease progresses *slowly*, for years; clearly distinguishing it from the sudden result of fracture. *Other articulations* being or becoming affected, would leave no doubt as to the nature of the hip-condition. Thus, the finger-joints are often attacked, being greatly deformed with nodulated chalk-stones; while the ball of the great toe is frequently much enlarged, and the joint partially dislocated inwards. The *general health* is often little disturbed, the disease appearing as a local affection. Males are attacked far more often than females, and thin persons mostly. Chronic rheumatic arthritis, affecting the hip-joint, seldom occurs under the *age* of forty; differing in this respect from scrofulous disease of the joint, as well as in its pathology and symptoms.

TREATMENT.—See Chronic Rheumatic Synovitis.

Neuralgia of the Hip.—The *diagnostic* Symptoms of Neuralgia are pointed out in connection with affections of the NERVES.

Neuralgia of some duration is attended with the alterations of attitude consequent on disease of the joint—whether scrofulous or rheumatic. The weight of the body being habitually thrown on the sound limb to relieve the affected joint of the other side, the limb on the painful side becomes *apparently lengthened* and *flexed*, the toes touching the ground; the pelvis is inclined obliquely to the same side, and some compensatory lateral curvature of the lumbar spine results. But, with neuralgia, no real shortening of the limb ever ensues.

Disease of the Sacro-iliac Joint.—The *cartilaginous lamella* of the sacro-iliac articulation seems to be the *seat* of a disease, occasionally affecting this joint. Ulceration of the cartilage, as the primary change, involves the synovial membrane—when present; both of which structures are thus destroyed more or less completely. But the ligaments remain unaffected, or are only partially destroyed; and the adjoining osseous surfaces seldom become carious or necrosed. This disease is of very rare occurrence. It may be *associated* with sacral caries, or with extensive disease of the hip-joint.

SIGNS.—1. *Pain* is one of the earliest symptoms. It is confined to the region of the joint, and increased by any movement or position whereby the weight of the body is thrown upon the sacro-iliac joint. Thus, walking, stooping, or even standing, is attended with a sense of painful weakness in that situation, and as if the body were *falling asunder*. When the pelvis is at rest, or fixed in the recumbent position by the hand of the Surgeon, for examination, the *hip-joint* may be moved in any direction without pain, or stiffness of that articulation. The pain acquires a gnawing or rheumatic character as the disease advances. Sometimes the pain extends down the limb, or into that of the opposite side, as proceeding from the pressure of an intra-pelvic abscess lying on the sacral plexus. 2. Inability to support the weight of the body occasions an *insecure, wriggling gait*, from side to side. There may be the additional symptoms of some difficulty in micturition and defæcation. 3. *Swelling* makes its

ence over the joint; it is pulpy and elastic, and of an elongated form along the line of the articulation. 4. The limb is *apparently elongated*, to a drooping of the pelvis on the diseased side, the limb being to support the trunk; and this side of the pelvis is tilted forwards. Usually, the *anterior superior spine* of the ilium is both on a *lower and more prominent forwards*, than on the sound side. Measurement, however, from that prominence to the inner malleolus shows that the limb is not elongated; that any apparent lengthening—say, half an inch—is not due to any change in the three large joints, or in the bones of the limb; but that it must depend on some alteration *above* the sacro-iliac joint. 5. Usually, the limb is *straight*, and becomes so as the disease progresses.

An abscess occurs at a late period. It forms over the diseased articulation, spreads in various directions. The matter may point posteriorly to the articulation, passing upwards perhaps to the loin, upon and just above the crest of the ilium, there forming a fluctuating swelling of variable size; or extending outwards over the buttock, it reaches as nearly to the trochanter, as a great gluteal abscess. In both situations, lumbar and gluteal, the abscess is *extra-pelvic*. *Intra-pelvic*, the matter accumulating within the pelvis, may pass out through the sciatic notch, and thence under the gluteal muscles; or gravitate downwards into the ischio-rectal fossa, and present by the side of the rectum, or vagina; or open into the rectum and discharge per anum. 7. The *drooping* of the limb takes place, in consequence of, and proportionate to, the destruction of the sacro-iliac articulation.

DIAGNOSIS will have to be made between this disease, and that of the hip, disease of the pelvic bones, sacral caries, spinal disease, aneurysm of the hip, and sciatica.

As compared with disease of the *hip-joint*, sacro-iliac disease differs less notably in nearly *all* the symptoms: the loose, wriggling rather than dragging lameness of the limb; the early accession of pain and its situation—in the sacro-iliac joint,—with the *absence* of pain in the hip-joint and the sympathetic sensation on the inner side of the thigh; the *absence* also of hip-stiffness. The *swelling* which supervenes is remote from the articulation which is affected. There are certain features of resemblance to disease of the hip-joint—in the *lengthening* of the limb on the affected side, accompanied with *drooping* and obliquity of the pelvis on that side; but it will be noticed that the *anterior superior spinous process* of the ilium is not only lower—it is *more prominent*, in sacro-iliac disease, consequent on the tilting of the ilium forwards on the diseased side. The limb is also somewhat abducted and everted. Ultimately, shortening of the limb, and wasting, as destruction of the sacro-iliac articulation ensues.

Pelvic caries, with abscess, is distinguished from sacro-iliac disease by the *different situation* of the presenting *swelling*—in the iliac fossa, or tuberosity of the ischium; and there is *no pelvic obliquity* and *no drooping* of the anterior superior spinous process. *No shortening* of the limb ensues.

Sacral caries may exist independently, or be conjoined with sacro-iliac disease. The *craggy* portion of the bodies of the sacral vertebrae

being the seat of the disease, the signs are obscure; but the *swelling*, and even the pain, are located more *over* the *sacrum*, and, low down, may be detected per rectum. Abscess points near the great trochanter, in the course of the pyriform muscle, or in the groin, as a pelvic abscess, or it may be diverted into the ischio-rectal fossa.

4. *Spinal caries* can hardly be mistaken; for, being seated commonly in the dorsal region, the *angular excurvation* of the spine is removed from the sacro-iliac articulation.

5. *Neuralgia* affecting the hip is *unattended* with all those *objective signs* which relate to structural disease; and the *severity* of the pain, its paroxysmal character, and migration perhaps to some other part of the body are very unlike the tender or fixed painful swelling of sacro-iliac disease. The age and sex of the patient will probably aid the diagnosis; a young, hysterical female complaining of intense pain about the hip, diffused, superficial, or even cutaneous, and aggravated by the slightest handling, is not an affection likely to mislead the experienced Surgeon, who is intent upon discovering any evidence of structural disease. *Sciatica* also, as a painful affection, will be traced in the course of the great sciatic nerve, from the great sciatic notch downwards, external to, and lower down than, the pain of sacro-iliac disease; and which is unaccompanied with any swelling or other objective evidence of structural disease. Occurring, generally, at a more advanced period of life, and associated with a rheumatic tendency, our sciatic patient is soon recognized as a far more familiar friend than the very rare case of sacro-iliac disease we may happen to meet with.

CAUSES.—Acute inflammation of this articulation may result directly from *injury*; as in a case given by Louis, a sack of corn having fallen on the loins of a man who was stooping at the time. To rheumatism or gonorrhœa, one case each may be assigned. No difference of liability can be traced to *sexual* predisposition, beyond the tendency arising from *pregnancy*. In one case only, both articulations were affected.

The *COURSE* of this disease, as already indicated, is most unfavourable; and thence the prognosis is equally so. Continuing for months or years, the *termination* is nearly always fatal.

TREATMENT.—The same treatment, local and constitutional, as for disease of the hip-joint, represents the little that can be done in disease of the sacro-iliac articulation. Counter-irritation may have some beneficial influence on the carious disease; but *recumbent rest* of the articulation is more important, and is to be secured by *weight-extension* from the foot, with a *long external splint* to steady the limb.

Removal of the diseased articular surfaces, by excision, is, of course, out of the question; but the removal of any carious portion, by *gouging*, or the extraction of a sequestrum, will be within the reach of art. I have thus operated successfully in two cases. *Deep abscess* may be drained, and washed out with weak antiseptic solution. In the event of recovery, the relaxed joint should be supported by a pelvic belt, controlling also the hip.

CHAPTER XXXIV.

EXCISIONAL SURGERY OF THE JOINTS AND BONES.

The Joints; for Disease, and Deformity.

Excision or Re-section, as it is sometimes less properly named, signifies the removal of any part of the body, by a cutting-out operation of extirpation. This kind of operation relates chiefly to the Joints and Bones, although it may be practised also for the removal of tumours, as adventitious growths produced in connection with the natural organism. With regard to the osseous system, comprising the Joints and Bones, Excision may be practised either for Disease or for Injury of these parts.

Joint-Excision in relation to the General Treatment of Joint-Disease.—In the course of *inflammatory* joint-affections, certain general indications of Treatment may be recognized, which, in the order of their conservative or preservative character, admit of the following arrangement; and whereby the *relative* bearing of Excision will become apparent.

The **NON-OPERATIVE** indications comprise :—

- (1.) Preservation of the Joint, functionally, by restoration of its Mobility.
- (2.) Preservation of the Joint, with loss of its mobility, by Anchylosis.

The **OPERATIVE** indications are :—

- (3.) Preservation of the Limb, and Life, by sacrifice of the Joint, with Anchylosis, here more properly named Synostosis—EXCISION.
- (4.) Preservation of the Life alone, by sacrifice of the Limb—AMPUTATION.

General Conditions of Diseased Joints appropriate for Excision.—**FUNCTIONAL INUTILITY** of a Joint is the *resultant* condition for which the operation of Excision is appropriate; but as this may ensue either from persistent disease, or from failure of the natural cure, the latter of a twofold character, it includes three general conditions, proper for the operation :—

Firstly,—as the result of persistent disease—*destruction* of the articular cartilages, with *perhaps* *dislocation*, without the supervention of *anchylosis*; but whilst the *constitutional* condition has *not* *advanced* to hectic and emaciation.

Secondly,—as one result of the natural cure—Anchylosis, of a nature *inappropriate* to the functional use of the limb; being ligamentous where osseous union is required, namely, in the knee; or osseous where ligamentous connection is necessary, as in the hip or elbow, or any other joint except the knee.

Thirdly,—as another result of the natural cure—Anchylosis, with *malposition* of the limb. In the event of *fibrous* anchylosis, with malposition, mechanical extension of the limb, tenotomy, or both these resources may be tried prior to excision of the joint. *Ossous* anchylosis also, with malposition, may be subjected to certain operations of subcutaneous osteotomy; e.g., in relation to the hip and knee joints.

Certain **SUBORDINATE** conditions, relative to the propriety of Joint-

Excision for persistent disease, are less clearly established by an analysis of cases.

(1.) The comparative eligibility of chronic synovitis or of scrofulous caries would appear to be in favour of the *former* disease.

Professor Humphry's experience is somewhat different—at least with regard to the knee-joint—prolonged scrofulous suppuration of the thickened synovial membrane having been the most frequent cause of failure after excision, in his cases. (*Medico-Chirurgical Trans.*, 1869.)

(2.) A *limited extent of osseous disease* would seem to be proportionately favourable for excision; but *one* or *both* articular surfaces, or *ends* of bone, may be diseased. (a.) The disease must not extend beyond the limits necessary for the formation of sufficiently *wide* osseous surfaces for an adequately secure union, osseous or ligamentous according to the functional use of the limb. (b.) Or the limits of diseased bone, with relation to excision, may have to be restricted for the preservation of a sufficient *length* of limb; and, consequently, for the preservation of the *epiphyses* or epiphyseal cartilages, as affecting the subsequent growth of long bones, and thence of the limb. The epiphyses of the tibia and femur, in the knee-joint, for example, in relation to the growth in length of the lower limb, after excision of this joint. But section of an epiphysis, or even its entire removal, is not a prohibitory consideration, with regard to joint-excision; seeing that the length of a limb, as depending on epiphyseal growth, will probably be arrested in consequence of inflammatory affection of the epiphyses from disease of the joint.

(3.) Disease of the *soft parts around* the joint diseased is not, in itself, unfavourable to the result of excision; even although the integuments be much undermined by sinuses, and thickened by gelatinous infiltration, or soddened by puriform discharge. This surrounding condition of disease will subside, and the integuments regain a healthy state, when the central source of irritation, the diseased joint, is extirpated; provided only sufficient sound integument be left to *cover* the exposed ends of bone. But any considerable disorganization of the integument is generally connected with advanced constitutional disturbance and hectic exhaustion,—the most unfavourable condition for joint-excision.

(4.) A *chronic* state of disease, in the joint and surrounding soft parts, is a condition of far more favourable character for excision, than one of *acute* inflammation.

(5.) In all doubtful cases, as to the diseased condition of the joint, a good practical rule is, to lay the articulation open, by an incision as for the operation, and examine its condition, before having recourse to amputation, which can then be performed at once.

(6.) Certain co-existing *constitutional diseases*, as phthisis, seem to have an unfavourable influence, and in proportion to the progress of such disease.

(7.) *Age* has no special constitutional relation to the propriety of joint-excision. Either extreme period of life seems unfavourable for this kind of operation, owing to the long period of recovery; averaging three months at least for the knee or hip joint, and six weeks for the elbow-joint.

Sub-periosteal Excision.—This method of excision essentially consists in detaching and reflecting the periosteal membrane, by means of variously contrived paring-elevators or other instruments; then the

ed portion of bone is sawn off; and, lastly, the membrane is re-
 that by its preservation the bone may be reproduced. This con-
 ve procedure is applicable alike to the removal of the articular ends
 e in the excision of joints, and of the shafts of bones, partially or
 y. The *tendinous insertions* of muscles are to be detached with the
 eum.

no *advantages* result from this modification of excision, when suc-

l. *Firstly*, the reproduction of *substi-*
one, which may be required after re-
 of the articular ends of bone to an
 al extent in joint-excision, and which
 be necessary after the excision of a
 considerable portion in the shaft of a
 thus, in either case, to *regain* as much
 sible the *original length* of the limb.
 the great importance of sub-periosteal
 on with regard to the *knee* or *hip*
 than relative to the elbow or shoulder,
 ngth of the arm being of less conse-
 e to the functional utility of the limb.
 and advantage of the operation is that
tendons detached with the periosteum
regain a better attachment than after
 ry excision. On the other hand, as
 ng the joints alone, the sub-periosteal
 lure would be *disadvantageous* where
 s union and a *movable joint* are desired,
 he case of all the articulations, except-
 e knee; unless, in other excisions, such
 usual length of bone be removed as
 impair the use of the limb.

he **RESULTS** of sub-periosteal excision
 ot generally been successful, although
 are notable instances of considerable
 luction of bone. This mode of opera-
 as been practised chiefly by Ollier,
 mbeck, Dr. Sayre, and some other
 ons in the excision of joints; principally
 p, shoulder, elbow, and knee.

Special Excisional Surgery of the
is for Disease. (Fig. 47.)—The

Knee-Joint.—**OPERATION.**—The patient
 recumbent, and under the influence of
 form, the limb, already bent by retrac-
 if the leg consequent on the joint-
 e, is firmly held by an assistant so as
 sent the knee vertically; his one hand grasping the thigh, the other
 the leg, the foot of which rests on the table. The knee-joint is most
 niently laid open for excision by a curved *horseshoe-shaped* incision

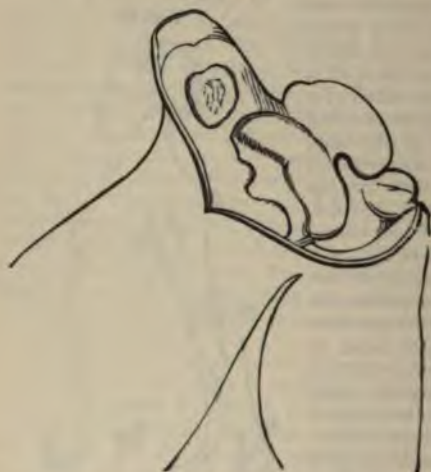
FIG. 47.



Figure showing Lines of Incision for Excision:—1. Of the Knee; 2. Hip;
 ale; 4. Elbow; 5. Shoulder; 6. Wrist.

(U), extending from the side of one condyle downwards across the tibia, *just below* its articular surface, to the same point on the opposite condyle. Thus both ends of bone are exposed. A sweep of the knife, dividing the ligamentum patellæ, will fairly open the joint from side to side, when a touch or two over the remains of the lateral ligaments completely lays it open; the joint being at

FIG. 48.



time forcibly flexed (Fig. 48). In young subjects, with ankylosis, care is taken to sever the union with the femur by forcible flexion. The epiphysis become movable. The joint having been opened, I raise the integument with my hand, hooking my finger under the patella, and with particular care not to divide the integument of the femur, I draw the skin across just above the articular end of bone, and define it for excision with a small, broad saw, one, is applied in at a right angle to both vertically and

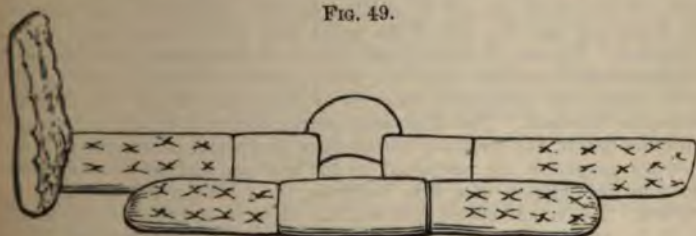
allowance for the projecting direction of the articular end—upwards, in the flexed position of the limb, as held by the assistant. In this direction be observed, the section of bone will be oblique to the vertical. The popliteal vessels and nerves are quite out of the way in this section, the saw inclining forwards towards the articular surface of the femur and the ligamentum posticum intervening. To make the tibial section, the saw similarly in front of the head of the tibia, on the line of incision about half an inch below the articular surface, the integument being necessary for this purpose, and the blade at a right angle to the bone, or parallel to the articular surface to bring the edge out about half an inch below it posteriorly. Since the “lion-forceps” is a useful instrument for the purpose of grasping and holding steadily either articular section of the bone, when detached by the saw.

Excision of the joint may be performed in a *block*, instead of by section, when the articular ends of bone are firmly ankylosed; the bone cut out having a V shape, owing to the projection of the ward from constant retraction of the leg.

The parallel surfaces of bone, thus made in either way, lie in apposition when the limb is extended. This is the most important consideration with relation to the formation of firm osseous union.

oblique direction of either surface is most unfavourable to this result; too much space intervening at one part for the formation of an intermediate plate of bone, and the remainder of the surfaces being tightly locked, the limb cannot be flatly extended; painful startings of the limb ensue from attrition of the surfaces in contact, and no intermediate plate of bone can be produced. Thus, the union would be in part imperfect or ligamentous, and in part incomplete or wanting. A second section must be made from either end of bone, if necessary, to reach a *healthy surface*, or gouging may

FIG. 49.



be requisite; but the extent of bone excised should be limited by the considerations already explained, and the surfaces must always be finished off *parallel*. The *patella* is then removed, avoiding the making of a button-hole in the integument.

Any *thickened synovial membrane*, often slate-coloured, should be *dissected out* entirely.

Hæmorrhage is easily arrested by torsion or catgut ligature of the articular arteries, or any other small bleeding vessels.

I then extend the limb, and having seen that the ends of bone lie in even apposition—not absolute contact—a flat piece of sponge is held in the wound while the splints are applied. The extended limb is laid on a padded *back-splint* covered with oiled silk under the knee, this splint reaching from the *fold of the nates* to *just above the heel* (Fig. 49). The *foot-piece* forms part of the *lateral splint*, as thus the *heel* escapes pressure and consequent

FIG. 50.*



tendency to sloughing. *Broad strips* of adhesive plaster are drawn round the limb and splint, immediately above and below the knee, another broad strip high up on the thigh, and a narrow strip around the ankle—thus securely fixing the whole limb (Fig. 50). A *roller-bandage* is also

* *Royal Free Hospital.* (Author.)

applied from the ankle upwards, and another up the thigh, leaving the knee uncovered. An *outside interrupted splint* (see Fig. 49), well padded, and covered with oiled silk above and below the interruption at the knee, and provided with a *vertical foot-piece*, is now applied; this splint reaching from above the great trochanter downwards, and the *end of the thigh-piece* well supporting the very end of the femur externally, at the seat of incision, while the perpendicular *foot-piece* maintains the leg in position, and the *upper end of the tibia* in steady apposition with the femoral end of bone. This splint is secured by a *roller-bandage* from the foot to below the knee, and by another bandage from above the knee, up the thigh, and over the end of the splint, with two or three turns around the pelvis. The use of the external splint is to counteract the tendency to displacement of the lower end of the femur, in three directions, after excision of the knee-joint—projection outwards by abduction, rotation outwards, and projection forwards. The *thigh-piece* corresponding in length and breadth with the femur, any tendency outwards is prevented; while eversion and forward projection are restrained by the bandage, and the latter displacement by the support of a firm mattress, or at least a pillow under the buttock. I have had occasion to lengthen this *side-splint* up to the axilla, so as to counteract a tendency to an angular twist of the trunk to the opposite side in bed; whereby the lower end of the thigh is abducted, with an angular projection outwards at the knee.

Lastly, the *sponge* is removed from over the excision-wound, any dirt wiped out, the ends of bone finally seen to be in apposition, and then the flap of integument closed down evenly by points of suture. Tannin, or carbolic gauze, may then be used for dressing; and over all a roller-bandage is applied to further exclude the air, and maintain some compression to prevent oozing and secondary hæmorrhage. The patient is removed to a bed close at hand, the limb elevated on pillows to a height of about six inches, and a cradle placed over the excision.

The operation of excision, as thus described, has been variously modified in the hands of different Surgeons. 1. Thus, the preservation of the patella being deemed important, in order to leave the ligamentous attachment to the tibia intact; the triceps extensor tendon would have to be drawn aside, to excise the articular ends of bone, in the operation as performed by Jones, of Jersey. 2. Volkmann making a transverse incision, from condyle to condyle of the femur, the patella is sawn through, and the ends of bone excised; then the two halves of the patella are united by catgut, or wired together. The articular surface of this bone should be scraped, if necessary to remove a diseased portion. 3. The excised surfaces of the femur and tibia may be united by wiring them together so as to fix the bones more securely in position. The bones are drilled by means of Brainard's perforator, through the anterior half of either end, on the outer and inner sides; and two stout silver wires are passed through, and the ends twisted close up to the bone; thus clamping the surfaces, externally and internally. The twists should be bent down sideways close into the bone, not to irritate the flap of integument, in the healing of the wound. I have obtained excellent results from this mode of operation, in four cases consecutively (1885); the wires remaining imbedded permanently, without producing any irritation. But the wire-ends especially sometimes prove troublesome; necessitating a reopening of the wound to remove them, although the bones may be firmly

united. And this has occurred in spite of the most rigorous antiseptic precautions.

AFTER-TREATMENT with regard to joint-excision, is very simple. But I would urge the importance, with reference to the after-treatment of knee-joint excision in particular, of one rule: not to *reapply* the splints before the end of a month or six weeks, unless absolutely necessary to correct some important displacement. At the end of another month's interval—the second month—on removing the splints, I gently *test* the progress of osseous union, by placing my *finger* over the line of junction, and slightly moving the lower end of the leg up and down. At the end of the *third month*—and in many cases, after two months—on removing the splints, the trial of union may be made, by seeing whether the *patient can himself raise the limb* from the bed, by its own muscular action. If so, a starched bandage may be applied, provided with a back-splint and an external splint of pasteboard; and the limb being slung from the neck by a long loop of roller-bandage, the patient may be allowed to get about on crutches to completely regain his general health.

A high-heeled shoe or boot may be worn, to compensate for any shortening of the limb. But, ultimately, some obliquity of the pelvis partly compensates for the shortened state of the limb.

THE GROWTH OF THE LIMB in length, after excision of the knee-joint, is a question which can only affect the propriety of this operation in *youth or childhood*. The two epiphyses—upper and lower—in a long bone are not equally productive of its longitudinal growth; one is a more active organ of growth than the other. In the tibia and humerus the upper epiphysis is thus more important; in the femur and radius, the lower epiphysis. But the lower *femoral epiphysis* would appear to be *relatively* more important to the longitudinal growth of the femur than the upper tibial epiphysis is to the elongation of the tibia. Hence, with reference to excision of the knee-joint, removal of the *femoral* epiphysis will more especially arrest the subsequent growth of the limb in length. The growth of the *foot* also is arrested, so that it may become insufficient to sustain the weight of the body. All this arrest of development may be reduced still further by the imperfect growth from previous disease.

The rule already laid down as to excision of the knee-joint in young subjects, under the age of about ten or twelve years, should be observed.

Excisional or Section Operations for Deformity of Knee-joint.

—**Knock-knee or In-knee—Genu Valgum.**—Inclination of the knee inwards is attributed, by some observers, to an hypertrophic elongation of the inner condyle; but this deformity appears to be really due to lengthening of the inner portion of the *shaft* of the femur, at its lower end, giving an inward obliquity to the shaft, and thus carrying with it the inner condyle, downwards and inwards. When the length of the shaft, just *above* the condyles, on the inner and outer side, is compared, the inner portion will be found to lie on a lower level, without any elongation of the condyle. But the inward projection of the knee may also result from *rachitic incurvation* of the lower portion of the femoral shaft, coupled with a similar incurvation of the upper portion of the tibia; there being an opposite curvature—outwards, in the femur above, and in the tibia below, the incurvations; thus forming an S-shaped curvature in either bone. In

OSTEOTOMY.—Certain operations of osteotomy for the knock-knee,—otherwise incurable—have been practised with success. As a rule, no osteotomy is permissible until all means for rectifying the deformity have been tried, and patient has passed the age when the bones are yet pliant to the force of gradual pressure—say, after about the tenth year.

(1.) The *inner condyle* of the femur may be cut off sufficiently on the shaft to make the limb straight (Ogston's method). The *shaft* of the femur, *just above the condyle*, may be excised of a wedge-shaped piece of bone, from the *inner* shaft (Macewen's method); or section of the shaft, in the *externally* (Barwell's method?), will allow a ∇ interval to the limb is straightened. Now, the *choice* of either of the operation must be determined mainly by the cause of the deformity.

Ogston's *inter-condyloid* method—by section of the *inter-condyloid*—proceeds on the *assumption* that *elongation* of that portion produces an apparently inward inclination or obliquity of the femur. Thence the elevation of the condyle will rectify this deformity of the knee. This procedure is now rarely practised, and Dr. Ogston has, I believe, abandoned it in favour of the supra-condyloid operation.

In performing either of these operations, the only *instruments* are—a long-handled narrow-bladed tenotomy-knife, a similar chisel having a blade of sufficient length and breadth for the bone to be divided, with a hammer for working this instrument. Osteotomy consists in penetrating the tenotome down to the bone to be divided; then, while maintaining the track of the instrument in position by the grasp of the other hand, the saw or chisel is applied to the same spot, or, perhaps more surely, by sliding the instrument to the same spot, or, perhaps more surely, by sliding the instrument to the same spot, or, perhaps more surely, by sliding the instrument to the same spot, or, perhaps more surely, by sliding the instrument to the same spot. When the cutting edge should be driven into the bone by a succession of blows, keeping the blade as steady as possible.

first, followed by the others, a *wedge-shaped gap* is thus formed, without removing any osseous substance. Or, a triangular portion of bone may be removed with the chisel. The remaining connection—about the outer third of the shaft—snaps when the leg is straightened. This osteotomy lies evidently above the epiphyseal line.

Barwell has transferred the operation to the *outer side*; and here, of course, section, without excision, suffices to bring the limb down straight—leaving a gap to be filled up by osseous formation. The knife is entered just above the outer condyle, to reach the femur, followed by the chisel. Sometimes this osteotomy is coupled with section of the *tibia* and *fibula*, above the knee; so as to halve the angular interval left in the femur. This additional section will always be necessary to rectify the deformity in rickets.

Max Schede, of Berlin, believing that the deformity of knock-knee is best rectified by operating on the *tibia*, this bone has been subjected to excision of a *wedge-shaped piece*, just below the tubercle. The operation, as thus performed and in this situation, has proved successful.

Having regard to the tension of certain fibrous textures—the external lateral ligament, the biceps femoris tendon, and the ilio-tibial band—in connection with knock-knee, these structures, as the apparent cause of the distortion, have received the attention of some Surgeons.

TENOTOMY has, therefore, been proposed to *substitute* any operation of osteotomy. One or more of the resisting fibrous bands are divided, as may be necessary to rectify the deformity. But the operation is reserved only for *extreme* cases of genu valgum, up to seventeen years of age; and the limb may thus be restored both in shape and function. It would appear, however, to be a good resource only in the *early* condition of knock-knee—before lengthening of the shaft, above the inner condyle, has rendered osteotomy indispensable.

Hip-joint.—**OPERATION.**—The hip-joint deeply placed, owing to the neck of the femur, is reached most conveniently by a T-shaped incision; the *vertical line* being made from just above the great trochanter downwards on the shaft to about three inches or less in extent, and the *transverse line*, perhaps slightly curved, about half that extent on the summit of the longitudinal incision. The very limited extent of this latter incision avoids the femoral vessels anteriorly, and the crural nerve posteriorly. By detaching the integument on either side of the vertical incision, keeping the knife turned towards the femur, especially on its inner side, the subjacent portion of femoral shaft is exposed; then, sinking the knife vertically in the transverse incision, just above the trochanter, the attachment of muscles thereto is divided; so that the finger can be readily passed down to the joint and its state ascertained. The capsular ligament will generally have given way or entirely disappeared. To turn out the remnant head of the femur for excision, it may be necessary to *adduct* and *evert* the limb, when, with a touch of the knife on the bone, the round ligament yields and the head starts from its pocket. Or this ligament also may have disappeared, and the head and neck of the femur be so reduced, and the acetabulum so patulous, from more advanced disease, that the bone can be readily dislodged and hooked out with the finger. In a third class of cases, dislocation backwards has taken place. In any case, however, adduction of the limb across the opposite thigh presents the bone for

application of the saw; and then the diseased portion is removed by or more successive slices with a small saw, the integument on either being protected by a curved retractor (Fig. 51). The chain-saw may be used by those who prefer it. A gouge may be useful to finish off the femoral excision; instead of unnecessarily removing any healthy part of the trochanter, if that be left, or of the adjoining shaft. Instead of dislodging the portion of bone to be removed, I now more often excise *situ*, by passing a long, narrow-bladed saw down to the line of section, the advantage being the much smaller wound requisite, and with

FIG. 51.



disturbance of the soft parts. The *acetabulum* should be *scraped* rather than gouged, to remove any carious or diseased portion; or more extensive *pelvic* excision may be necessary, and has proved successful. But superficial caries, acetabular or pelvic, will often recover itself after the former having been maintained by constant attrition of the femoral head. hæmorrhage is easily arrested by tie. I have never had occasion to apply a single ligature in any hip-joint excision.

EXCISION OF THE TROCHANTER.—This may occasionally prove sufficient; but excision of this portion of the femur existing without disease of the hip-joint. I have had one such case, and with a successful result.

AFTER-TREATMENT.—The limb may be laid straight in bed, and supported in position only by small side supports or roller sand-bags, without any

fixing the thigh; but weight-extension being used just to separate the section end of the femur from contact with the acetabulum. Or an *interrupted splint* may be applied simply to fix the limb, *without tension*. The section end of the femur is drawn up by muscular traction, and hitches just above the acetabulum, which having been, generally more or less superficially carious, is thus left to recover itself, undisturbed by any attrition of the femoral end of bone; while a new, and fibrous, movable joint forms, where the end of bone rests upon the acetabulum.

SUB-PERIOSTEAL EXCISION OF HIP-JOINT.—The operation of excising the hip-joint sub-periosteally, with the object of preserving the periosteum for reproduction of bone, to obtain an increased length of limb, has been practised in the hip-joint more particularly.

ATROPHY of the *shaft* of the femur has been known to occur after a sequence of excision of the head and great trochanter; the cartilage having disappeared, and the walls of the shaft being reduced to a shell of compact bone, fracture would be apt to take place in the standing or walking. But this contingency after excision is very rare, the bone generally retaining its former strength.

Section, instead of Excision, of the upper end of the femur, is a procedure which has been devised and practised for failure of the natural

—osseous, instead of ligamentous ankylosis of the joint, with useless malposition of the limb, as by flexure on the thigh and adduction.

SUBCUTANEOUS section, in the *neck* of the femur, was first proposed and practised by Mr. William Adams. The object of this procedure is to procure an artificial movable joint; that result having failed, osseous ankylosis, but with the limb in a straight position, is sought to be established. A long tenotomy-knife is entered a little above the great trochanter, and passed down to the neck; the capsule is opened, and the neck of bone divided by a narrow saw, applied from before backwards. This osteotomy may be supplemented by tenotomy; as of the long head of the rectus, the adductor longus, and tensor vaginæ femoris muscles. The limb is brought down straight, and fixed by a long interrupted Liston's splint.

But there are *two* classes of cases to which subcutaneous section of the *neck* of the femur is inapplicable; the resulting ankylosis and malposition of the limb being the same.

Firstly, *scrophulous* disease of the hip-joint, in an *advanced* stage; with destruction of the head, and of the neck of the femur so far as to leave only a *nodule* of bone above the great trochanter. Adams's operation must be ineligible, there being no femoral neck to divide.

Secondly, another class of cases inappropriate for the latter operation is when the previous ankylosis from disease is attended with an *exuberant deposit of new, nodular, and hard bone* around the neck of the femur, producing considerable thickening and induration of the bone in that situation; as in *chronic rheumatic arthritis*.

SUBCUTANEOUS SECTION OF THE FEMUR, BELOW THE TROCHANTERS.

—The *Infra-Trochanteric* Operation.—I first performed this operation on December 10th, 1872, as reported in the *Lancet*, December 21st. The patient lying down, the thigh about to be operated on is directed across that of the opposite side, owing to the angle of malposition. I grasp the front of the thigh with the left hand, below the trochanters, and turn the mass of muscle somewhat outwards, planting my thumb rather below the outer side of the femur, to mark the point of incision. A stout tenotomy-knife, set in a long handle, is entered at that point, and passed down to and over the femur, so as to make a transverse line across the bone; then the knife is withdrawn, and still keeping the thumb in position, not to lose the track of the narrow subcutaneous incision, a thin, narrow-bladed saw, set in a long handle, is entered at the same point, and passed along the track of the wound, over the femur (Fig. 52), which is then readily sawn through, observing not to work the instrument beyond the length of the serrated portion, about two inches in extent, thus to avoid lacerating the soft textures on either side of the shaft. Only a few drops of blood escape from the puncture-wound, without any perceptible *débris* of bone. On feeling that the thigh is suddenly loose and movable at the seat of section, the thumb of the left hand is slid over the puncture, followed by a similar application of a lint compress as the thumb is withdrawn, in order to preclude the admission of air; thus making this subcutaneous osteotomy exactly similar to a subcutaneous tenotomy. The compress is secured by cross strips of adhesive plaster, and further by the turns of a roller-bandage, pretty firmly applied around the thigh. The limb is brought down in a straight position from below the seat of section, making a more or less perceptible angle with the trochanteric portion

above; and a long, straight, interrupted splint is applied, as for excision of the hip-joint, and bandaged in the usual manner. In the event of muscular

FIG. 52.



contraction, it may be desirable to use weight-extension from the ankle, as in fracture of the thigh.

Osseous union takes place in six weeks or two months, according to the age of the patient.

A *chisel* offers no advantages over the saw. It has been urged that the bone-dust produced by sawing is detrimental to primary union; the liability, however, of splintering the bone in working the chisel, and of damaging the deeper soft parts, by a sudden intropulsion of this instrument, are greater perils. After one such section, below the trochanters, by Mr. Bryant, deep-seated suppuration ensued, pyæmic infection, and death. (*Lancet*, December 22nd, 1877.)

FIG. 53.*



Ankle-joint. — OPERATION. — Hancock's description of excision of the Ankle-joint, as first performed by him in England (1851), is as follows:—"I commenced an incision behind, and about two inches above, the external malleolus, carrying it forwards beneath that process across the front of the joint, and terminating about two inches above and behind the inner malleolus (Fig. 53). This incision included the skin, without implicating the tendons or their sheaths. The flap thus formed was dissected up, and the peronei tendons were detached from the groove behind the fibula and cut through, as were the external lateral ligaments close to the fibula, with a pair of bone-nippers. I next divided the fibula about an inch and a half above its inferior extremity, and cutting through the inferior tibio-fibular ligaments, detached the external malleolus. Turning the leg on to its outer side,

* After Hancock.

I cut through the internal lateral ligament, carefully keeping the knife close to the end of the tibia, to avoid the posterior tibial artery. The tendons of the tibialis posticus and flexor communis were then detached from the groove behind the internal malleolus, and taking the foot in both hands, I dislocated the foot outwards, thus bringing the end of the tibia, with the internal malleolus, prominently through the wound. These were removed by a common amputating saw, applied half an inch above the horizontal articulating surface of the tibia, the soft parts being protected by a spatula; the upper articulating surface of the astragalus was also removed by a metacarpal saw, held horizontally. The foot was then restored to its proper position, the cut surface of the astragalus being adapted to the cut surface of the tibia; and the wound having been closed by sutures, except on the outer side, left open for the free escape of discharge, the leg was placed on an *external splint*, having an opening corresponding to the wound."

The parts divided by this operation are—the skin, peronei tendons, internal and external, lateral and inferior tibio-fibular ligaments, and the articular surfaces of the bones. In subsequent operations, the tendons were preserved entire. In no instance have the tibial arteries, anterior or posterior, been wounded, and never has it been necessary to apply a single ligature.

Lateral incisions alone, without the anterior communication, have since sufficed. This was my mode of operation in two cases.

AFTER-TREATMENT.—The fixed position of the foot must be maintained during the period requisite to secure a firm fibrous union of the osseous surfaces made by excision—the lower ends of the tibia and fibula, and the upper surface of the astragalus; thus to adapt the foot for support and progression. The wounds, one on either side of the ankle, are dressed antiseptically; but the splint should be removed and reapplied *very seldom*. In my own excisions of the ankle-joint, I have fixed the leg on a *flat back-splint*, provided with a *foot-piece*; thus secured, displacement can scarcely occur, and the side wounds are freely accessible for cleansing and dressing. Eventually, a starched bandage may be applied; and the foot being slung from the neck, the patient gets about on crutches, and the foot is gradually brought into use.

Tarsal Bones.—Excision of the Tarsal Bones comprises certain recognized operative procedures, which correspond to the lines of the osseous articulations; as removal of the astragalus, or of the os calcis. But the plan and performance of excisional operations on the foot should not be restricted by these anatomical limitations. The modification of these operations on the foot, according to the kind and extent of the disease, well illustrates the guiding principle of Excisional Surgery.

The **CONDITIONS OF DISEASE** for which excisional operations on the foot may become appropriate, are similar to those which affect other bones and their articulations; namely, the destructive results of inflammation, and especially in the form of caries. According to the extent of such disease, partial or complete excision of any one, or more, tarsal bones may be necessary.

(1.) **EXCISION OF ASTRAGALUS.**—An *incision* along the *outer and anterior aspect of the ankle*, will expose the bone; its neck should then be severed with strong cutting-pliers; and, some space having been thus

made, the bone may be drawn out of its bed by the lion-forceps, the being used to detach its ligamentous connections, but applied caudad towards the inner side of the joint, in proximity to the plantar art. The external lateral ligament must be divided, and the posterior part of the internal lateral—attached to the astragalus; the peronei tendons *brevis* and *tertius*, and the *extensor brevis digitorum*—will be severed; the tendons of the long extensor of the toes should be protected by a retractor, and the tendon of the *peroneus longus* drawn backwards preserving the tendons of these muscles. It may be necessary to extract the bone piecemeal, when its substance breaks down in a carious state must then be gouged out.

(2.) **EXCISION OF OS CALCIS.**—The operation is thus performed:—patient lying on his face, with the sole of the foot uppermost, an incision with a stout bistoury, may be commenced at the calcaneo-cuboid articulation, just above the sole of the foot, and carried backwards round the foot forwards, to an equal point on the inner side. The sole-flap of integument is raised forwards from the under surface of the os calcis, and in its thickness down to the bone, so as to form a good cushion; a slight perpendicular incision is made, opposite the *tendo-Achillis*, into this horizontal incision, and with a little reflection of the integument to either side the tendon is severed from its insertion. The knife is then entered posteriorly over the upper surface of the os calcis, and the strong interosseous ligament connecting it with the astragalus is divided, somewhat as an eye is opened; the bone can then be raised, and its lateral attachments cleared by a gentle application of the knife, the calcaneo-cuboid articulation is opened, and the bone completely detached.

Or, an incision may be made, as for Syme's amputation at the ankle joint, and a heel-flap having been formed, the os calcis is exposed; the incisions are continued, on either side, along the sole of the foot to the point of the calcaneo-cuboid articulation, whereby a short sole-flap is reflected forwards; and the operation completed as before. The objection to this plan of excision is the liability to sloughing of the heel-flap, in disease of the os calcis; fistulous openings frequently having formed posteriorly where the flap is attached. The advantage of a heel-flap is that the excision can be readily converted into Syme's amputation, in the event of the astragalus being found to be extensively involved. Apart from the contingency of sloughing, I prefer the sole-flap method of excision affording a more free access to the os calcis.

SUB-PERIOSTEAL excision of the os calcis may be performed after the method of Ollier; the calcaneum being reached by a curved external incision along the bone, from the *tendo-Achillis* to the calcaneo-cuboid articulation. The periosteum, thickened by disease, can be easily detached. But the mortality is about double that of the operation without attempt to preserve the periosteum.

Excisions for Deformity.—**EXCISION OF THE CUBOID BONE** has been practised occasionally, for the cure of otherwise intractable talipes equino-varus. In some extreme cases, even a wedge-shaped piece of bone has been removed from the tarsal arch; including the cuboid and the fifth metatarsal bones, with the head of the astragalus, and part of the scaphoid and of the external cuneiform bones.

The scene of operation having been rendered bloodless by the ap-

Esmarch's bandage and coil, an **H** incision is made over the cuboid of the thickened bursa which usually overlies this part of the tarsal bone. The double flaps are reflected and held back by retractors; a triangulation of bone is cleared, so that the apex corresponds to the hinge of the joint on the inner side of the foot, and then this exposed portion of the bone is gouged out. On rotating the toes outwards, the symmetry of the foot could be restored; or a little bevelling off may be required until a normal position of the foot is obtained. The flaps of integuments are drawn in and closed with metallic sutures; and the limb placed in a sort of plaster's splint, having an embracing foot-piece, worked by a screw to maintain an everted position. The wound heals, not without some discharge, which drains away freely from the dependent base of the excision; but anostosis or ankylosis taking place between the remaining tarsal bones, a solid foot results in the course of two or perhaps three months. The liability of an *adverse* issue is obvious; the synovial prolongations of the remaining articulations of the foot become involved by diffuse inflammation, and suppuration and caries may necessitate amputation at the ankle-joint, or higher up, in the leg. This risk must be taken into account in estimating the merits of an operation devised to avoid a mechanical inconvenience,—incurable otherwise.

Elbow-joint. — OPERATION. — The incision is thus formed,—a *single linear* incision, longitudinally over the centre of the arm, and of sufficient length to turn out the bone, is preferable to any other, in regard to a speedy recovery after operation. The various forms of incision offer special advantages. An **H** shape exposes the joint more readily, on reflecting the flaps, marked out, upwards and downwards (Fig. 54). A **+**-shaped incision, with the vertical line parallel to and a little outside the ulnar nerve, allows of its being more guarded or drawn inwards, by a retractor in the hands of an assistant.

In either case, the transverse incisions should be made across the end of the olecranon process to condyle; or nearly to the inner condyle, in the latter form of incision; and thus the joint is laid open. With a little detachment of integument on either side, the knife is entered transversely above the olecranon, dividing the tendon of the triceps,—the ulnar nerve being protected; the olecranon process must then be sawn off transversely, and by flexing the arm and, perhaps, dividing the lateral ligaments with the touch of the knife, the articular surfaces of the three bones are fully exposed. Mr. Maunder has shown the importance of preserving the structures between the external condyle and the olecranon, and of dividing the outer portion of the triceps with its tendinous prolonga-

FIG. 54.



tion, the fascia, and the anconeus muscle, forming a continuous band; whereby active extension of the forearm may be secured. The articular surface of the humerus, between the condyles, is excised by means of Butcher's saw (see Fig. 54); and the sigmoid surface of the ulna and head of the radius, in like manner, or removed with pliers, or simply gouged. The latter two bones should not be removed below the insertions of the brachialis anticus and biceps muscles; for thus the brachial artery will be protected by the intervening brachialis muscle from any fair risk of injury, in removing these portions of bone; and, by preserving the insertions of both muscles, the voluntary flexion of the elbow, eventually, is rendered far more complete.

When requisite, a more *extensive excision* may be made, by applying the saw *above the condyles* of the humerus across the olecranon fossa; and below, just *beneath the lesser sigmoid cavity* of the ulna, *including the head of the radius* at that line. Any surrounding *out-growth* of bone, resulting from exuberant reparative action, must not be mistaken for disease; it should not be included in the excision. But any thickened synovial membrane should be dissected out.

The line of incision having been closed with sutures, the arm is placed semi-flexed on an *angular splint*; at first, in nearly a straight position; afterwards, somewhat bent, as ligamentous union takes place. To prevent osseous union, passive motion should be gradually commenced—say in a month after operation.

Shoulder-joint.—**OPERATION.**—An elliptical incision, *U*, exposes the joint most thoroughly for examination, and facilitates the application of instruments; but, by severing the deltoid muscle, at the turn of the incision, the voluntary abduction of the arm, subsequently, is much impaired. A single *longitudinal incision* is nearly as effectual, and avoids the after-disadvantage referred to; or an *L* or a *T* incision may be preferable; and, in truth, the shape of the flap must be guided by the state of the integument with regard to sinuses or otherwise. Supposing an elliptical to be selected:—A bistoury is entered at the posterior border of the acromion, and carried down with a sweep across the insertion of the deltoid, upwards to the inner border of the coracoid process. The flap, embracing the deltoid muscle, is raised by a few touches with the knife; then, the external rotator tendons are divided, by running the blade across the great tuberosity of the humerus; and, by slight abduction and rotation of the arm outwards, the tendon of the subscapularis, attached to the small tuberosity, is touched with the knife, and thus the head of the humerus is turned out of the glenoid cavity,—the capsular ligament having disappeared. Or the *single linear incision* may be made on the *inner aspect of the joint*, between the *acromion and coracoid processes* of the scapula, where the head of the humerus is most prominent. The head of the bone is then exposed, and presented in like manner; the soft parts being well retracted by an assistant with a curved retractor on either side, while just freeing the muscular attachments (Fig. 55). Then, protecting the soft parts and long tendon of the biceps with a spatula on the inner aspect of the bone, the saw is applied below the diseased portion. The head, neck, and proximate part of the shaft may be thus removed; avoiding, if possible, the circumflex arteries. Any carious portion of the glenoid cavity may be scraped with a gouge. As a rule, with very rare exceptions, the glenoid cavity should

not be excised. The flap is replaced, or the linear incision closed, and retained by sutures; and the arm, with an *axillary pad*, may be *bound to the chest*, as for fractured clavicle; or supported on a pillow, extending as a splint from the axilla. Subsequently, the forearm must be supported in a sling, and the arm gradually brought into useful motion.

Wrist.—**OPERATION.**—**PARTIAL** excision consists in the removal of only one or two of the carpal bones, or other limited portions of the bones, forming the wrist. This procedure can be readily effected by slitting up any fistulous aperture leading to the carious bones, and extracting it by bone-nippers and forceps.

COMPLETE excision may be performed in either of three ways. The choice of method is mainly determined by the consideration of difficulty in removing the affected bones, without dividing the extensor tendons of the fingers and thumb; the supinator tendon, radial and ulnar extensor tendons inserted into the bases of the metacarpal bones, being comparatively unimportant, in consequence of the firm fibrous anchylosis of the wrist after operation, if the result be successful.

First method.—A *curvilinear incision* is made, extending from just above the styloid process of the radius, downwards across the back of the wrist, and upwards to the same level above the styloid process of the ulna; the flap of integument is reflected, *carefully* avoiding the extensor tendons of the fingers, and those of the thumb, on the ulnar half and external border of the radius. Then, dividing the supinator tendon, and the two extensor tendons of the carpus, and flexing the wrist, the radio-carpal articulation is opened; and, while the other extensor tendons referred to are drawn aside with a curved retractor by an assistant, the articular ends of the radius and ulna, the carpal bones, and bases of the metacarpus, are successively removed by a small saw or cutting-pliers introduced transversely.

Second method.—Two *lateral longitudinal incisions* are made, one on the ulnar, the other on the radial, side of the wrist; thus *readily* avoiding the extensor tendons of the fingers, and that of the second joint of the thumb. The operation is then continued as before, and completed by excising the bones in the same manner.

Lister has particularly pointed out that there are two obvious and important objections to the lateral method, which somewhat resembles that which he has devised. Firstly, the radial incision is so placed, as probably to sacrifice the extensor tendon of the metacarpal bone, and that of the second joint, of the thumb. Secondly, with regard to the bones, that in dividing them, an unnecessarily large amount of bone is removed from the radius and ulna, and from the metacarpus,—a loss of length and breadth which interrupts the process of consolidation, and results in a more narrow wrist and impaired strength of the hand. Moreover, that the

Fig. 55.



bones being divided *in situ*, some portion of the disease may probably be left behind.

To obviate these difficulties in performing the excision, and to avoid the tendons requisite for the efficient use of the hand and fingers, another method of operation has been proposed and practised by Lister. It consists in two essential peculiarities:—the *radial* incision is so placed, on the dorsal aspect of the radius, as to avoid the tendons which are otherwise liable to be implicated—the extensor ossis metacarpi pollicis, and the extensor secundi internodii; while the limited, but complete, excision of the bones is accomplished by first removing the *carpus*, and then the articular ends of the radius and ulna, and the bases of the five metacarpal bones.

The details of the operation are fully described in the Author's larger work on "Surgery."

Arthrectomy or Erasion of Joints.—(For the following valuable description of this operation, I am indebted to my colleague, Mr. W. H. Battle.) "By this term I mean the removal of diseased tissues, usually of a tubercular nature, from the interior of a joint exposed by means of suitable incisions, by a combination of scraping and cutting. It differs from excision in that in the latter operation the articular surfaces are removed by the saw, and the freshened surfaces of bone adapted to one another and placed in close contact, with the view of obtaining bony ankylosis. Brought prominently before the profession by Wright, of Manchester, in the year 1881, it has since been extensively employed in surgical practice, both in this country and on the Continent, and has met a want long felt by those engaged in the treatment of joint-disease. Its usefulness has been especially apparent in the treatment of joint-disease in early life, as the operation does not interfere with the continued growth of the epiphyses and future development of the limb. For many years it was the custom to perform excision of the knee for nearly all cases of intractable disease, and its performance in the case of young children gave rise to such ill-developed, useless limbs, that many Surgeons abandoned that operation, excepting when the patient was over six years of age. This meant that numerous cases of tubercular disease were left in a hopeless condition for years, during a most important period of life, or amputation of the limb was performed. This method of operating has been employed, with modifications, in most of the joints, but principally in the knee, elbow, and ankle, though its practice after the removal of bone in excision of any joint, where that is indicated, is to be commended. As the knee is the joint in which the operation is most frequently required, I will describe the method which I employ in the erasion of that joint. The surface of the joint having been carefully washed and rendered thoroughly aseptic, any sinuses are mopped out with chloride of zinc solution. The limb is rendered bloodless, and Esmarch's band applied to the thigh. Long lateral incisions are made, extending from the upper limit of the synovial pouch to below the level of the joint; these are joined by a transverse incision across the middle of the patella, which bone is sawn across. The flaps are dissected upwards and downwards, and the interior of the joint carefully examined. The extensions of the synovial pouch are now removed by means of forceps and scissors, access to the posterior part of the joint being obtained by flexion after division of the lateral ligaments. The crucial ligaments are carefully cleaned, and the inter-articular cartilages

removed. From time to time the joint is irrigated with solution of perchloride of mercury, 1 in 1000, and when all the disease appears to have been removed, any bone diseased having been thoroughly scraped, the surface is washed out with chloride of zinc, 40 grains to the ounce, again with perchloride solution, and a wire passed through the two portions of the patella. Any vessels now visible are secured by forceps, and Esmarch's and removed, vessels which now show themselves being caught in the forceps; these are now all tied with catgut or twisted, and the band applied. The patellar surfaces are adapted, the wire twisted, and the ends hammered down. The whole wound is closed with interrupted catgut sutures, accurately across the middle line, but with considerable intervals at the sides. The blood and antiseptic lotions which may remain in the joint are expressed; the wound is dusted with iodoform, covered with protective, and surrounded with gauze and absorbent wool, firmly bandaged in position. The limb below is also firmly and evenly bandaged from the ends of the toes to the joint, and Esmarch's band taken away. The thigh is then bandaged over wool, the limb rendered immovable by splints, and elevated for four and twenty hours. The indications for dressing the case are severe pain in the joint, marked rise of temperature, evidence of interference with the circulation below, or oozing from the wound. If drainage-tubes are put in, or wire stitches used to close the wound, it is necessary to dress the case within forty-eight or fifty hours to remove them. This change of dressing should take place with the patient under the influence of an anæsthetic."

EXCISION OF BONES.

Excision of the Scapula.—**OPERATION.**—**PARTIAL** excision of the scapula, for caries or a tumour, will require an *incision*, varying in shape and extent, according to the portion of bone, or the size and relative position of the tumour, to be removed. The *body* of the scapula may be excised by a T-shaped incision, so placed as to correspond to the spine and middle of the body of the bone. The flaps having been well reflected, and the bone or tumour thoroughly exposed, the saw is applied below the spine and the neck of the bone, which is then dissected out of its bed. Hæmorrhage may be inconsiderable, unless the subscapular or the dorsal artery be divided. The *spine* of the scapula can be readily exposed by an incision along its projecting border from the acromion, or to include this process if necessary. The bone is removed by a small saw or cutting-pliers, care being taken to avoid the joint, if the acromion be removed. Hæmorrhage will probably be inconsiderable, no vessel of any consequence having been severed. I have thus removed this portion of the scapula with little difficulty. The *supraspinous* portion of the bone might be reached by a similar procedure.

COMPLETE excision of the scapula may be accomplished by a similar operation to that for the removal of the body of the bone; a T-shaped *incision*, but extending from the acromial end of the clavicle to the posterior border, and vertically downwards to the inferior angle, of the scapula. The flaps, thus marked out, are to be well reflected; then the *acromio-clavicular articulation* must be divided, or the adjoining portion of the clavicle or the base of the acromion may be sawn through, the *muscles* attached to the

coracoid process must be *divided*, and the *shoulder-joint opened*, carefully avoiding the axillary artery and plexus of nerves on its inner aspect; lastly, the *muscles* attached to the superior and posterior borders of the bone are *divided*, with the *supra-scapular and dorsal arteries*, and the bone is raised from behind forwards to the axilla, there dividing the *subscapular artery* in completing the severance of the axillary attachments. Or, the bone may be raised from the axilla backwards, dividing the subscapular artery in the first instance; a less convenient method of procedure, owing to the copious hæmorrhage. The vessels must be secured by ligature or torsion; and the amount of hæmorrhage will be perilous, in proportion to the vascular character of the tumour. The flaps of integument are replaced and retained by points of suture.

Excision of the Clavicle.—PARTIAL excision of this bone, for necrosis, may be accomplished by an incision along the affected portion of bone, which, lying subcutaneously, can be removed with tolerable facility. The sternal end of the clavicle has been excised on account of its pressing on the œsophagus, in a case of permanent dislocation backwards.

COMPLETE excision of the clavicle, for an osseous tumour, may be undertaken in like manner, by an excision extending along the bone from end to end; but, owing to the subjacent parts, the removal of the entire bone is a proportionately more formidable operation.

In the upper and lower extremities, the long bones have been each subjected to excision—partially, or completely, as with regard to the Radius, Ulna, and Fibula.

CHAPTER XXXV.

AMPUTATIONS.

General Directions.—Amputation is the removal of any part of the body by a cutting operation of severance. This kind of operation relates chiefly to the Limbs.

The conditions of Injury or Disease, which necessitate Amputation, I have already considered in previous chapters—especially with reference to Contused Wounds, Compound Fractures and Dislocations; it remains only to here describe the Operations themselves.

Certain directions are common to all Amputations.

INSTRUMENTS.—Few and of simple construction, amputating instruments and appliances comprise—a tourniquet, for preventing hæmorrhage by compression of the main artery, or Esmarch's bandage and elastic coil; *amputating knives*, of various lengths and shapes; a *saw* (see figure, amputation of thigh), and *cutting-pliers*, for removal of any spiculum of bone; *artery-forceps* or tenaculum, for seizing or hooking arterial vessels; *torsion-forceps*, for twisting them; *ligatures* of hemp, silk, or antiseptic catgut; *suture-needles* and silk or wire; strips of diachylon or isinglass plaster, and roller-bandages, sponges and lint, with a supply of cold

course included among the requisite surgical appliances. personal examination of these instruments will enable the student to understand them far better than by any lengthened description. The roller, the bandage, and the elastic coil are thus applied: The patient is elevated for two or three minutes, thus by gravitation to fill the artery with blood in it, the roller is applied, with uniform compression from the foot upwards to where the artery is to be compressed; being placed upon the artery, the elastic coil is drawn over the pad, by one or two turns, as may seem necessary, secured by a wooden groove-catch. Before applying the coil, the foot is protected with a layer of lint, or two or three turns of a

ents should be arranged on a small table or tray close at hand, or the assistant handing them to him; and he should have everything is prepared before he begins the operation. The same applies equally to all Surgical Operations.

are required, varying in number according to the magnitude of the injury. One assistant specially to administer chloroform, another to compress the artery—if digital compression be applied; a third to support the limb, and a fourth to support the limb, and, after its removal, to support the limb, as the arteries are seized by the operator. Thus the operation will be conducted in an orderly manner. In an emergency, one assistant will suffice, if they be instructed to do double duty.

of Amputation.—Two forms of Amputation are practised: one, by transfixion and cutting two flaps outwards, or one the other outwards, as regards the passage of the knife; the other, by cutting from the skin towards the bone by a transverse line, successively applied, with retraction of the flaps, or by two oval semicircular sweeps, progressing inwards towards the bone. A combination of these two methods is also practised; as by a single long flap on one aspect of the limb, and another on the other.

Fig. 56.

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compute; the *integuments* must then be *drawn up* by an *asp* the limb with both hands. Holding the knife lightly, but

FIG. 56.

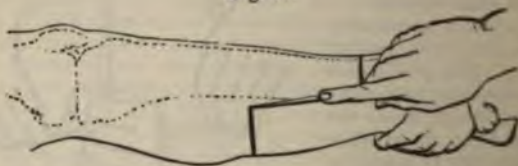


securely, the operator passes it under the thigh, bending his hand back until the edge of the knife lies on the inner and anterior surface of the thigh (Fig. 56). Sinking the edge through the *skin*, he carries it deliberately round under the limb, and then over it, gradually changing the bend of the wrist, until the hand is as much inclined forwards as it was in the opposite direction; and thus completes a circular incision. Whatever be the extent of retraction produced, the integuments should still be drawn upwards, evenly around the limb; the knife is again applied as before, at the line of retracted integuments, and made to sweep round the limb, passing half an inch or more through *aponeurosis* and superficial muscular fibres. The assistant, continuing to draw upwards, presents a fresh surface high up, and passes his hands down into the wound to secure the surface already gained; a third time the knife is made to encircle the limb, at the upward line of the second incision, dividing the *muscles, large blood-vessels, and nerves, down to the bone*. Retraction being continued by the assistant, some muscular fibres may be made to appear, attached to the bone for an inch or more above the line where the knife first touched the periosteum; these are divided with the point of the knife. The saw must then be applied at the *highest part* where the bone is exposed, and the bone sawn across transversely; the saw being worked freely from point to heel, and not fiddled irregularly. In making retraction deep towards the bone, it may be requisite or advantageous to employ a *retractor*—a broad piece of linen, with a longitudinal slit in it; this appliance proving more efficient than the fingers. In practising circular amputation on the dead subject, the flaccid state of the muscles, as contrasted with their tonicity during life, even under the influence of chloroform, will render it unnecessary to employ a retractor or to use the more forcible manual retraction, above directed; but this difference only affords another illustration of the general distinction between operations on the dead and the living.

On allowing the integuments and muscles to fall down and regain their position, a *conical cavity* is formed, sloping gradually from the circular line in the skin, as the base, up to the bone, as the apex of the cone; presenting a loose but fleshy stump. The vessels are secured, and the integuments adjusted by sutures, as in the flap amputation.

AMPUTATION BY A LONG AND SHORT RECTANGULAR FLAP—TEALE'S OPERATION.—The object of this method of amputation is twofold—to procure a more useful stump, and to diminish the mortality of the operation.

Fig. 57.



Accordingly, the *long flap* is formed from that side of the limb which does not contain the principal blood-vessels and nerves, and is made long enough to fold easily over the end of the bone, its length and breadth being

equal to half the circumference of the limb; while the *short flap* is one-fourth its length, and contains the vessels and nerves divided transversely (Fig. 57). No dressing is used, and the stump should not be lifted for many days.

Stumps.—A *good stump* comprises certain essential requisites:—that the bone be provided with *ample covering* of soft textures; and so formed that the *bone-end* shall not bear directly on the line of union in the resulting cicatrix; that the *nerves* be divided sufficiently high up to prevent their extremities becoming adherent to the bone-end or to the cicatrix, and, being thus deeply covered, to protect them from external pressure, and from atmospheric influence.

DRESSING OF A STUMP is best learnt in the Accident ward of a Hospital.

Morbid Conditions of, or affecting, the Stump.—(1.) SECONDARY HÆMORRHAGE.—Hæmorrhage is named secondary when it occurs after an interval of a few hours, or days, more or less, subsequent to an injury; but when occurring within the shorter period, the bleeding is commonly known as *reactionary* or *intermediary*. It may arise from local or constitutional causes. LOCAL causes comprise: 1. the use of a *septic ligature*; 2. the *misapplication* of a ligature, as when, not having been applied transversely, or when, having included some surrounding texture, it shifts its position or loosens; 3. a *collateral branch* just above the ligature may be the source of hæmorrhage, if wounded, or lead to hæmorrhage from the ligatured vessel by disturbing the formation of a clot. In the one case, hæmorrhage occurs soon after ligature; in the other, when it separates. 4. A *diseased state* of the coats of the *artery* ligatured is also followed by hæmorrhage. 5. A *sloughy state* of the *wound*, or any condition adverse to repair, is equally conducive to hæmorrhage. CONSTITUTIONAL causes include: 1. *reaction* after the stump has been put up, many vessels not bleeding at the time the main trunk was ligatured, and even this vessel will not bleed in a state of great collapse; 2. *excessive reaction* has the same effect; 3. an *uplastic state* of the blood, as in septicæmia, will delay and impair the formation of clot within the vessel; and various *blood-poisons* also have this effect, or, by inducing erysipelas, spreading gangrene, or sloughing of the wound, the result is the same—secondary hæmorrhage.

The *phenomena* of such hæmorrhage are not, as with primary arterial hæmorrhage, a jetting stream of florid blood; but, after a while, the *blood wells up* from the wound, and oozes through the dressings; then ceasing perhaps, it recurs again in a few hours. A stump should, therefore, always be watched for some time after amputation; and in the event of blood oozing, its continuance should be tested by sponging the part dry and overlaying it with a piece of dry lint, so as to detect any further escape. The *period* when secondary hæmorrhage occurs is variable; separation of the ligature is always a time for vigilance.

TREATMENT must have reference to the presumed cause of hæmorrhage, as mainly determined by the period of its occurrence. EARLY secondary hæmorrhage—within a few hours or days—may generally be suppressed by *elevating* the stump, and the application of *cold and pressure* to the flaps, a compress above and below being used and the bandage tightened. This failing, the stump must be opened up, the *vessels* sought for and *tied*, and the flaps replaced when the bleeding is controlled. LATER secondary hæmorrhage—after ten days or a fortnight—proceeds, more probably, from

where, owing to the state of the parts, a ligature cannot be applied, or will not hold on the vessel. Temporary *compression* of the *main artery* *up*, will sometimes permanently arrest the hæmorrhage; or, *ligature up*, as by the Hunterian operation, may even be requisite. Either of these high methods may, however, fail, from not commanding the hæmorrhage; as when, the superficial femoral being stopped, the artery still supplies blood below, or owing to some occasionally irregular anastomosis of the bleeding artery. But the ligature of a main artery is especially questionable, as tending—in conjunction with a large wound—to increase the *grene* of the stump. In cases only of amputation near the trunk, the shoulder, the hip-joint, or upper third of the thigh, ligature of the main artery above may be a less disadvantageous, or even an unavoidable. In the event of any failure in arresting the hæmorrhage, different proceedings should be had recourse to *successively*. In the probable pre-existence of some causative condition, there may be a secondary hæmorrhage after amputation, or other operation, it is a judicious precaution to place a tourniquet around the limb, which can be tightened at any moment by the special nurse in attendance. By marking with ink the spot where pressure should be made in the event of the main artery, the nurse can be instructed thus to control the hæmorrhage. Even the patient may become an assistant, when necessary.

(2.) NECROSIS.—*Osteo-myelitis*, or *Gangrenous* inflammation of a stump, after amputation, are occasionally met with, and are treated accordingly.

(3.) CONICAL STUMP, with protrusion of the bone.—This condition arises, either from insufficient coverings of the bone at the time of amputation, or from *spasmodic retraction* of the muscles subsequently. In either way the bone projects, and the stump has, or acquires, a conical shape upwards from the bone as its *apex*. Sometimes, the bone is so firmly to protrude under a thin ulcerative cicatrix, which is unable to resist the slightest pressure or motion. Growth of the bone, in young per-

uses. Commonly, it arises from more than usually *bulbous enlargement* of the ends of the nerves in the stump, or from their *adhesion* to the *cicatrix*, or

FIG. 58.*



FIG. 59.†



to the *end of bone*, whereby also they are subject to external pressure or to atmospheric influence. *Excision* of any such enlargement will be necessary, or *subcutaneous division* of an adherent cicatrix. The end of the bone should be removed, to relieve pressure and tightness arising from that cause. An *hysterical* constitutional condition not unfrequently causes neuralgia and spasmodic twitchings in the stump, especially in females. No operative interference will be of the slightest use; and this condition must be treated, as best it may, constitutionally. In more rare cases a neuralgic affection of the stump, coupled perhaps with spasmodic con-

actions of the muscles, may depend on the formation of an *exostosis* at the end of the bone.

Particular Amputations.—Fig. 58.

Amputations of the Upper Extremity.—The Hand (Fig. 59).

* Figure showing lines for the formation of flaps in amputation.—Upper extremity: 1, at wrist-joint; 2, in forearm; 3, at elbow-joint; 4, in arm; 5, at shoulder-joint. Lower extremity: 1, Syme's amputation at ankle-joint; 2, Teale's amputation, in the leg; 3, amputation of leg; 4, at knee-joint; 5, in thigh, male's amputation by lateral flaps; 6, amputation by antero-posterior flaps; 7, at hip-joint.

† Diagram showing lines of incision from points of bone, in—1, amputation of index of finger; 2, finger; 3, thumb; 4, little finger; 5, at wrist-joint.



convex incision, di-
wards; then, runn-
across and throu-
bending it as needs
is turned flat under
and a semilunar
sufficient length
extremity of the b
with the dorsal in
other and reverse
this operation is-
the hand in the su
and with the finger
transfix on the
of the joint, and
blade flat on the

semilunar flap of sufficient length; then, passing the knife through the joint, to divide the skin almost transversely in the surface.

AMPUTATION THROUGH ANY OF THE PHALANXES may be in like manner. And, instead of amputating at the articulation and metacarpal phalanx, it is better, having made a short dorsal palmar flap, to cut through the middle phalanx with pliers; the insertion of the flexor tendon to move the first phalanx, remain a stiff spike if the amputation were performed at the

AMPUTATION OF THE ENTIRE FINGER, AT THE METACARPAL ARTICULATION.—Having placed the hand in the prone position, fingers, on either side of the affected one, drawn towards the assistant, the Surgeon lays hold of the finger, and entering a long narrow bistoury or scalpel on the dorsal aspect of the bone, about half an inch above the head of this bone an

third method consists in drawing the edge of the knife on the web, as in the finger, and in an oblique backward towards the middle line, the thumb nail on the palm. The joint is reached; the blade is then used round the head of the phalangeal bone, and brought outwards

FIG. 61.



FIG. 62.



through the web on the opposite side (Fig. 61). This method, though simple and rapid, requires practice. In other ways, disarticulation is aided by using the finger and lever. The bulky head of the metacarpal bone had better than be removed with long bone-sciens, introduced from the dorsal surface (Fig. 62), perpendicularly, and with the flat surface of the blade applied to the proximal end, thus nipping the bone cleanly across; unless it be the index or little finger, in regard to both of which the bone should be nipped across obliquely from without inwards, so

as to conform to the outline of the hand. After tying or twisting the distal arteries, the edges of the incision readily fall together into a line, the fingers being brought together, the gap is scarcely perceptible. A mar splint is applied, and simple dressing as usual.

The Metacarpal bone may be included by carrying the incision farther back; but it is better to leave the base of the bone,—not to open the st-joint, and care should be taken not to wound the palmar arch in saving the bone from its bed.

Several fingers, with perhaps their metacarpal bones, requiring removal disease or injury, the operation can be fashioned in a similar manner, using a very useful forceps-hand.

AMPUTATION OF THE THUMB, AT ITS METACARPO-PHALANGEAL ARTICULATION, is performed in precisely the same manner as for the removal of finger at the same articulation; but, if possible, the head of the metacarpal bone should always be preserved, any remnant portion of the thumb being specially serviceable. Hence, the incision from the dorsal aspect is to be carried forward on the radial side beyond the base of the phalanx, obtain sufficient flap-covering for the bulky head of the metacarpal bone. The result of this amputation will often be very satisfactory; the ball of thumb acquiring a considerable range of motion, and equal strength as opponent to the fingers. A more conservative method may sometimes be adopted; for I have succeeded in saving the joint, and with it, therefore, the insertions of the three other muscles—adductor, flexor, and abductor pollicis.

AMPUTATION OF THE THUMB, AT ITS CARPO-METACARPAL ARTICULATION, is the only amputation peculiar to the thumb. *Liston's method.*—commencing an incision just above the articulation of the base of the metacarpal bone with the trapezium on the palmar aspect, and continuing down the dorsal aspect of the bone, inclining slightly to the radial side,

the knife is sunk into the fold of the integument between the thumb

FIG. 63.



forefinger (Fig. 63); then, introducing the knife at this extremity of the incision, and thrusting it up along the palmar aspect of the bone, its point is made to emerge at the commencement of the incision, and the palmar integument divided outwards (Fig. 64); observing to carry the blade forwards to *opposite* the *dorsal incision*, at the root of the thumb, that the palmar flap shall entirely

FIG. 64.



cover the exposed surface of the web. The bone is twisted out, and disarticulated with a few touches of the knife; the lips of the oval wound form a single incision and eventually a linear cicatrix. In operating on the *right thumb*, be necessary for the Surgeon to cross his hands in an awkward manner unless he is ambidextrous. The order of amputation may, therefore, be reversed; first, by transfixion, the palmar flap is made, and then the

incision. Another method consists in carrying the dorsal incision downwards to within an inch of the metacarpo-phalangeal joint, and then in an *oval form* across the joint, up to the dorsal incision. When the flap is brought together there will still be a single line of cicatrix.

FIG. 65.



AMPUTATION OF THE LITTLE FINGER.
ITS CARPO-METACARPAL ARTICULATION
be performed in a similar manner.

Amputation of the Wrist-joint.
radio-carpal articulation is as easily opened as any of the joints in the hand. An assistant holding the forearm, the operator lays the back of the hand on its palmar aspect, with the forefinger and thumb on the styloid process of the radius and ulna; thus spanning the wrist, as the limits of the incision. A narrow-bladed amputating-knife is used instead of a bistoury, and an incision

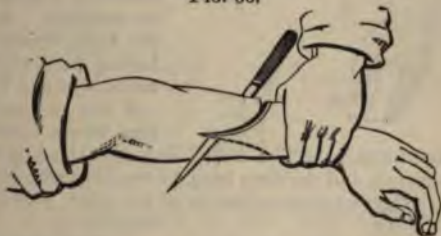
is made from one styloid process to the other, across the back of the joint, curving towards the hand (Fig. 65). Passing the knife across the back of the hand, clear of the arch-shaped surface of the carpal bones, the lateral ligaments are divided, and the knife carried forward on the palmar surface of the metacarpal bones, so as to make a rounded flap of sufficient length to the ends of the radius and ulna, and unite with the dorsal incision. Turning the knife round the joint, care must be taken not to divide a

the *pisiform* bone, which projects forward on the palmar aspect, beyond the other bones of the carpus. The *radial* and *ulnar* arteries will require ligation or torsion, and perhaps some *interosseous carpal branch*.

This amputation, not often requisite, is intended to preserve the movements of pronation and supination. *Inappropriate*, therefore, for disease of the wrist, where the lower radio-ulnar articulation is involved, the operation is *suitable for injury* where no portion of the hand can be saved, but with sufficient sound integument to form the palmar flap.

Amputation of the Forearm.—The middle of the forearm is the part to be preferred for amputation, as affording the most convenient coverings to the stump, and a tolerably suitable length of stump for the application of an artificial hand. The brachial artery must be commanded by an assistant, and the forearm held by another assistant, in a state of *extension and semi-pronation*,—the radius looking upwards. The margins of the bones should be felt by the operator with one hand; a *posterior flap* is then made by a curved incision downwards; commencing on the *palmar margin of the radius*—on the left side—and continued a little way down along the bone, arching across the back of the forearm, and up along the *ulna* to a point on its *palmar aspect* opposite to the other horn of the incision, it thus extends forward sufficiently on either side for easy transfixion in front of the bones (Fig. 66). This flap is reflected by a stroke or two with the knife; and the point being entered at one horn of the incision, in front of the bones, and made to emerge at the other, an *anterior flap* of corresponding shape and length is formed, by carrying the knife from within outwards along the surface of the bones. Both flaps are retracted by an assistant. Sweeping the knife around the bones to divide any remaining muscular fibres, and cutting across the *interosseous membrane* with the point of the instrument, the bones are then sawn through together. The *radial*, *ulnar*, and *interosseous arteries* in the anterior flap must be ligatured or twisted, and the flaps adjusted with sutures.

FIG. 66.



This method of performing amputation of the forearm provides for easy transfixion, and is the most dexterous; but in a similar position of the forearm—semi-pronation, both flaps may be made by transfixion.

Amputation by a long anterior, and a short posterior, rectangular flap, on Teale's principle, will also form a good stump.

Amputation at the elbow-joint may be performed by transfixion in front of the joint, just below the condyles, and forming a sufficiently long anterior rounded flap; then, dividing the lateral ligaments with a touch of the knife on either side, the joint is opened, and the blade being carried round the olecranon, dividing the attachment of the triceps tendon, a short semicircular skin-flap is formed posteriorly. The articular surface of the humerus should then be sawn off.

But this amputation is seldom eligible, or necessary. When removal of the limb is requisite for injury, there is seldom sufficient sound integument for the anterior flap; and in the case of injury or disease of the elbow-joint, excision may generally be performed.

FIG. 67.

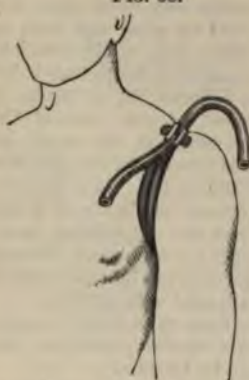


Amputation of the Arm.—An assistant compressing the brachial artery, the Surgeon makes a couple of *equal flaps*, an *anterior* and a *posterior*; simply by transfixing the arm in front of the humerus, and cutting a well-rounded flap, and then entering the knife behind the bone and making another such flap (Fig. 67). These are retracted by an assistant. A sweep of the knife cleans the bone, which is then sawn through; care having been taken that the *musculo-spiral nerve* was divided at the back of the bone—if the amputation be at that part of the arm where this nerve winds round behind

the humerus. The artery and any bleeding branches of magnitude are secured, and the flaps brought together with sutures.

Circular amputation, as in the thigh, will be preferable, if the limb be very fleshy.

FIG. 68.



Amputation by a *long external*, and a *short internal, rectangular flap*, on Tole's principle, may be practised with advantage occasionally. This method is suitable where sufficient flaps cannot otherwise be obtained, more often from wasting or condensation of the muscles, in *disease* of the forearm.

Amputation at the Shoulder-joint.

—**LISFRANC'S METHOD.**—An assistant standing above the shoulder, compresses the subclavian artery as it passes over the first rib; or, if he knows the operation practically, he may be trusted to catch the artery with his thumbs in the inner flap. Esmarch's elastic coil can be applied in the axilla and carried over the shoulder (Fig. 68), an appliance which dispenses with the service of this assistant. An assistant holds the arm up so as to *relax* the *deltoid muscle*. The

Surgeon—operating on the *left arm*—introduces a long-bladed amputating-knife at the *posterior border of the axilla*, and passing it in front of the joint, makes it emerge at the *anterior border of the deltoid muscle*, about an *inch below the point of the acromion*; cutting downwards and outwards, a large flap is formed chiefly of the *deltoid muscle and skin* (Fig. 69). This flap is raised by an assistant at the shoulder, and the arm brought down towards the front of the chest; thus presenting the head of the humerus and muscles attached to the tuberosity. Running the knife

across the joint, these are divided, with the *capsular ligament*, and the knife turned to the inner side of the joint,—followed by the hand of another assistant ready to compress the artery, when the vessel is to be thus secured.

The arm is again raised to give freedom in making the flap, and the knife carried downwards close to the bone, forming an *inner flap corresponding to the outer one*; while at this moment the assistant in charge grasps the whole thickness of the inner flap with both hands, between his fingers and thumbs cross-wise, and catches the artery as it is divided. If this be done dexterously very little blood escapes. Amputation at the *right shoulder-joint* is performed in precisely the same way, only that the

FIG. 69.



shoulder is transfixed from before backwards, the knife being entered in front of the deltoid about an inch below the acromion, and made to emerge at the posterior border of the axilla. The *axillary artery* and other vessels having been tied or securely twisted, the flaps are adjusted with sutures.

Or, the outer flap may be made by incision from without inwards, and raising the flap upwards by two or three sweeps with the knife; a modification more suitable in amputation for disease of the arm, where the muscular texture has undergone atrophy or condensation; or where it becomes necessary to reflect a flap from a *tumour* of the humerus.

In cases of injury also, transfexion may be impracticable; when the arm cannot be conveniently raised, owing to fracture high up.

AMPUTATIONS OF THE LOWER EXTREMITY.

The Foot (Figs. 70, 71).—AMPUTATION OF THE TOES, at their PHALANGEAL ARTICULATIONS, and at their METATARSO-PHALANGEAL ARTICULATIONS.—These operations are performed in a manner precisely similar to the analogous operations on the Fingers. In amputations at the last-named articulations, the *incision* must be commenced proportionately further back than in the Hand, these articulations being situated at some distance above the web of the Toes; and it is undesirable to remove the head of the metatarsal bone, which would diminish the breadth and support of the foot.

AMPUTATION OF THE GREAT TOE, AT ITS TARSO-METATARSAL ARTICULATION.—With a stout bistoury, commence an incision on the dorsum of the foot, at the posterior extremity of the interspace between the metatarsal bones of the first and second toes; carry the incision forward to the ball of the great toe, and curve it inwards upon the ball to the sole of the foot, at a part opposite to the web between the toes; thence draw the knife back-

wards along the sole of the foot, parallel with the outer margin of the metatarsal bone of the great toe to a point *opposite* to the commencement of

FIG. 70.*

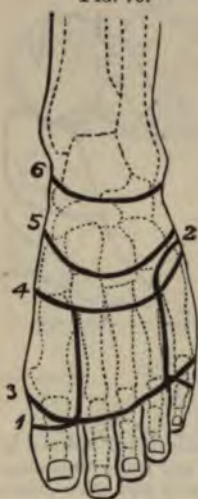


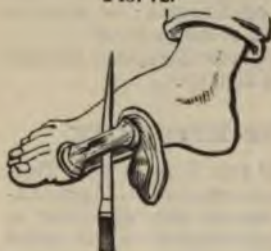
FIG. 71.†



the dorsal incision. Dissect the flap back, close to the bone; *divide the web* between the first two toes, avoiding the sesamoid bone here situated, and isolate the metatarsal bone; then, *twisting the great toe inwards*, pass the *knife* deeply into the *angle of the wound* and open the articulation with the internal cuneiform bone, detaching its ligamentous connections—but avoiding the termination of the dorsal artery by directing the knife *towards* the joint, and thus complete the amputation (Fig. 72).

The metatarsal bone alone can be removed by the first part of this operation; the flap being made *without* then dividing the web of the toes.

FIG. 72.



AMPUTATION OF THE LITTLE TOE, AT ITS TARSO-METATARSAL ARTICULATION.—This operation is analogous to that for the removal of the great toe; but the line of incision is here *single*. The knife is entered just behind the *prominent tubercle* of the metatarsal bone of the little toe, and carried inwards and forwards in the *oblique line* of its articulation with the cuboid; thence into the *fourth metatarsal interspace* forward to the web of the toe, and around under the toe, back into the incision on the dorsum of

the foot. The integument is dissected off, exposing the metatarsal bone, and the bone isolated; then, the toe being forcibly *drawn outwards*,

* Diagram showing lines of incision from points of bone, in—1, amputation of great toe; 2, little toe; 3, all the toes; 4, or at their tarso-metatarsal articulations; 5, through the tarsus, or medio-tarsal; 6, at ankle-joint.

† Diagram showing lines of disarticulation, or section of bone, in—1, amputation of all the toes; 2, at their tarso-metatarsal articulations; 3, through the tarsus, or medio-tarsal; 4, at the ankle-joint; and 4', with tuberosity of the scapula.

the joint is opened in the angle of the wound, and the operation completed.

AMPUTATION OF ALL THE TOES, AT THEIR METATARSO-PHALANGEAL ARTICULATIONS.—This is accomplished by making a slightly curved skin-flap on the dorsal aspect, and a corresponding but larger plantar flap. In disarticulation the line of the joint offers no difficulty. Torsion or ligature will arrest the hæmorrhage from the digital arteries.

AMPUTATION OF THE WHOLE OF THE TOES, AT THEIR TARSO-METATARSAL ARTICULATIONS.—HEY'S OPERATION.—This amputation is performed by a dorsal incision, slightly curved downwards, and a plantar flap,

FIG. 73.



FIG. 74.



the limits of which transversely are the *tubercle of the metatarsal bone of the little toe* and the *base of the first or the tubercle of the scaphoid bone* in preference; the flap extending forward sufficiently to cover the end of the tarsal after disarticulation of the metatarsal bones. The leg is placed with the foot downwards, and steadied by an assistant; the Surgeon grasping the fore-part of the foot and feeling with his finger and thumb the points of bone above mentioned, he makes a *semilunar incision* from the one to the other across the back of the foot, cutting down to the bone and reflecting this *short flap* of integument (Fig. 73). Passing the knife under the bases of the metatarsal bones from one horn of the incision to the other, and transfixing the foot, a longer flap is made from the *sole*, extending up to the *roots of the toes* (Fig. 74, 2). The irregular line of articulations is then opened with the point of the knife, while the fore-part of the foot should be forcibly depressed to facilitate disarticulation. The plantar flap is adjusted with sutures, and a single cicatrix remains on the dorsal aspect of the stump.

This amputation—by complete disarticulation—is, more correctly, *Lisfranc's operation*; Hey's *modification* consists in sawing off the *projection of the internal cuneiform bone*, and thus forming a more regular surface.

AMPUTATION THROUGH THE TARSUS—MEDIO-TARSAL—in the line of articulation between the astragalus and os calcis, posteriorly, and the scaphoid and cuboid bones, anteriorly.—**CHOPART'S OPERATION.**—The guides to this operation are the *tubercle of the scaphoid bone* on the inner side of the foot, and a point about *half an inch behind the tubercle of the fifth metatarsal bone* on the outer side of the foot, or about midway between this projection and the *front of the outer malleolus*. The opera-

tion is similar to Hey's, only that the incisions are commenced further back; the dorsal curved incision is made between the points of bone above named; the tarsal bones must then be disarticulated, and the plantar flap

FIG. 75.



formed, keeping the knife well turned towards the *under concave surface* of the *metatarsal bones*, and extending this flap forward to the *root of the toes*, where it should be rounded off across the sole of the foot (Fig. 75). The vessels are thus left uninjured, and an ample cushion formed. The *head of the astragalus* had better be *sawn off*.

Successful as Chopart's amputation may be in the formation of a useful stump, the ultimate result of this operation may prove most unsatisfactory, owing to changes in the position of the stump, as a weight-bearing support. Talipes valgus, or eversion, is unfrequently occurs; or talipes equinus, in worse position, whereby the weight is thrown upon the cicatrix, which thus becomes very sensitive and is apt to ulcerate. Tenotomy has

proved sufficient to counteract this tendency in some cases. Subject to this useless state of the stump, reamputation has become necessary in many cases.

FIG. 76.



FIG. 77.



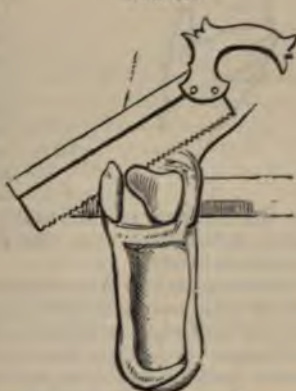
Amputation at the Ankle-joint.—**SYME'S OPERATION.**—This amputation consists in making a posterior heel-flap, and an anterior incision across the joint; disarticulating the foot, and taking a slice off the end of the tibia. The foot projecting over the end of a table, and at a right angle to the leg, a stout bistoury is entered at the centre of one malleolus, and drawn downwards and slightly backwards, under the prominence of the heel (see Fig. 74, 1), upwards and forwards to a corresponding point at the other malleolus (Fig. 76). Or, the heel-incision may be carried slightly forwards. The flap, marked out by this incision, is dissected back to the tendo-Achillis; the operator placing his fingers upon the heel, while his thumb rests upon the edge of the flap, he cuts between the nail of the thumb and the tuberosity of the os calcis, pressing

back steadily at the same time. In reflecting the integument around the tuberosity, the risk of making a *button-hole* will thus be avoided; and by still keeping the knife close to the bone on the inner side of the *os calcis*, the *plantar arteries* are not injured (Fig. 77). An incision is next made from one upper extremity of the heel-flap, across the *dorsum* of the foot, to the other extremity; then, depressing the foot, the joint is opened and the lateral ligaments divided by the point of the knife; the *astragalus* is disarticulated and the *tendo-Achillis* divided, as also any slight connection of the *os calcis*, and the foot removed (Fig. 78). A thin slice is sawn off the end of the *tibia*, including the two *malleoli* (Fig. 79). The *plantar arteries* are secured, also the anterior tibial or dorsal artery of the

FIG. 78.



FIG. 79.



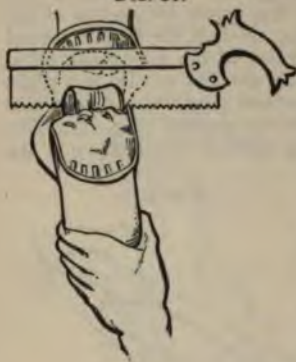
foot, and the heel-flap is brought forward to the anterior incision and retained by sutures. To prevent dropping and bagging of the flap, with a tendency to sloughing, especially if the *plantar arteries* have been cut off short, a *broad strip of adhesive strapping* should be drawn over the end of the stump, from the back to the front of the leg. An excellent stump often results, with only a transverse line of *cicatrix*. In some cases, retraction of the heel has occurred, from the action of the *gastrocnemius* and *soleus* muscles, producing an intractable ulcer in the most prominent part of the line of union; but this may be remedied by *tenotomy*—division of the *tendo-Achillis*.

Professor Pirrie makes a slight modification of this amputation, by sawing off the ends of the bones, *without* previous disarticulation of the foot; thereby shortening the operation.

PIROGOFF'S OPERATION is a modification of Syme's. It consists in preserving the posterior portion of the *os calcis*, which is retained in the heel-flap. This flap is reflected back about two lines; the anterior incision is made, the *astragalus* disarticulated, and the *malleoli* sawn off with a thin slice of the *tibia*; then the saw is entered behind the *astragalus* on the upper and back part of the *os calcis*, which is sawn obliquely downwards and forwards (Fig. 80). The posterior portion of the *calcaneum*, thus

left, is brought up into contact with the tibia; leaving the tendo-Achillis undivided, and forming a longer stump for support. The osseous surfaces may readily unite.

FIG. 80.



The chief *advantages* of this operation are the increased length of stump, and the less liability to sloughing of the heel-flap—the plantar arteries always being cut long and the general vascular communications remaining undisturbed. The *disadvantages* are the greater liability to osteo-phlebitis, owing to the section of two osseous surfaces; and the recurrence of disease in the portion of calcaneum left in the heel-flap. This latter objection, however, does not apply to the amputation when performed for injury.

Professor Pirrie has devised a simplification of this operation also, and one which includes his modification of Syme's amputation. The os calcis is sawn from *below*,—upwards and backwards; and then—having made the anterior incision—the

tibia and fibula are sawn through just above the malleoli, *without previous disarticulation* of the foot. But the downward section has always seemed to me more handy.

SUB-ASTRAGALOID AMPUTATION.—Removal of the foot below the astragalus is analogous to Syme's amputation; that bone being left and the operation performed *between* it and the calcaneum, at the articulation of these bones. A *heel-flap* having been made, as in Syme's amputation, an *anterior incision* lays open the articulation between the astragalus and scaphoid bone, as in Chopart's amputation; the knife is then passed backward between the astragalus and calcaneum, dividing the interosseous and other ligamentous connections, and the foot is removed. A *longer*, and as far more useful, *stump* remains than after Syme's amputation at the ankle-joint; but sub-astragaloid amputation is comparatively *rarely eligible*,—only when the astragalus is not involved.

HANCOCK'S OPERATION consists in amputation of the foot below the astragalus, leaving the *posterior third of the os calcis*, which is turned up against the under surface of the astragalus, prepared for its adaptation and union therewith by also removing the under surface and head of this bone. This operation, therefore, bears the same relation to sub-astragaloid amputation, that Pirogoff's operation does to Syme's amputation at the ankle-joint. As an improvement on sub-astragaloid amputation, Hancock's amputation provides a more *advantageous* stump, in two essential points; namely, the length of the limb, and the amount of leverage afforded by the astragalus for the artificial foot, and the consequent effects upon the movements of the ankle-joint. This operation would seem to be *suitable* for disease or injury involving the tarsal bones, excepting the astragalus, and when limited to the anterior portion of the os calcis—a rare coincidence.

Amputation of the Leg.—An assistant commands the femoral artery by digital pressure or compression with a tourniquet, or Esmarch's elastic

coil having been applied, the leg, projecting beyond the edge of a table, should be held horizontally by an assistant seated on a low chair or stool. The Surgeon, standing as usual so as to grasp the limb below the seat of amputation, enters the point of the knife at the *posterior edge of the tibia*—on the left leg—carries it *downwards* on the bone for about an inch and a half, curves the incision across the anterior aspect of the leg to the *posterior margin of the fibula*, and up that bone to the point

FIG. 81.



opposite its commencement on the tibial side (Fig. 81). The flap is reflected by a few touches with the point of the knife, which is then made to transfix the limb behind the bones from one horn of the anterior flap to the other—care being taken *not to lock* the instrument between the bones—and by cutting obliquely downwards and backwards, a *long posterior flap* is formed. The *interosseous membrane* is divided transversely, with the point of the knife, and a sweep round the bones clears a line for the saw. In applying the saw, the *fibula* should be divided first; otherwise, as a slender long bone, it will be splintered; and the *tibia* had better be *sawn obliquely* from before backwards, to make the anterior flap lay more easily than it would on the sharp ridge of a transverse section of the bone. Any projecting spiculous portion of bone must be clipped off with cutting-pliers. The arteries requiring ligature or torsion vary with the situation of the amputation; in the middle third of the leg, the *anterior and posterior tibials* between the bones of the stump must be tied; in the upper third just below the knee, the *popliteal trunk* may not have bifurcated, and one artery alone may have to be ligatured.

Another mode of performing this amputation is by transfixion and the formation of a posterior flap first, and then the anterior semilunar flap.

The stump, in either case, is apt to bag and drop, owing to the bulk and weight of the posterior flap; which is not less than three inches in length, and *bulky* in proportion to the muscular development of the calf. But the posterior flap may be made less bulky in the amputation; by directing the blade of the knife with a proportionate *curve downwards* in the calf, thus approaching to the formation of a posterior skin-flap—but still leaving a concave cushion to be turned upwards upon the tibia.

TEALE'S AMPUTATION, by a long anterior and a short posterior rectangular flap.—This operation obviates the mechanical difficulty last referred to; but its comparative merits in other respects, as a mode of amputation, have been already considered.

Amputation at the Knee-joint.—Two methods of performing this operation are occasionally practised; by a short anterior and long posterior flap, or by a long anterior and short posterior flap.

OPERATION BY A SHORT ANTERIOR AND LONG POSTERIOR FLAP.—A transverse or slightly curved incision is made across the knee-joint, *above the patella, from condyle to condyle of the femur*; the extensor tendon,

lateral ligaments, and crucial ligaments are successively divided, and the joint fairly opened; the knife is inserted behind the tibia, a long posterior flap cut downwards and backwards from the upper part of the calf of the leg, and the leg removed (Fig. 82). The *articular surface of the femur* is then *sawn off*, the *popliteal artery* tied or twisted securely, and the flaps brought together with sutures. But the cartilaginous surface may be left, without any risk to the healing of the wound. The stump made by this amputation may be most excellent, and as a permanent result.

OPERATION BY A LONG ANTERIOR AND SHORT POSTERIOR FLAP.—An incision is made from the lower margin of one condyle to the other, *extending below the patella* to a length of five inches across the tibia. The ligamentum patellæ must then be divided, and the flap of integument, including the patella, reflected; the lateral and crucial ligaments having been divided, the knife is passed behind the tibia, and a short abrupt flap cut outwards. The operation is then completed as before. The patella had better be left, for protection of the stump; but the cartilaginous

FIG. 82.



surface of the condyles may be advantageously *sawn off*. This mode of amputation at the knee-joint is now *generally preferred* to that by the short anterior flap.

Supra-condyloid Amputation may be performed in like manner as the operation at the knee-joint, only the *incisions* are placed proportionately *higher up*. The cartilaginous surface of the patella may be removed, and the bone brought down into contact with the end of the femur, as Gritti modified this amputation. But in my experience, the patella had better be removed, as a *section* is very liable to *necrosis*.

Certain *conditions* are relatively appropriate for these two amputations. 1st. If there be *no disease* of the *knee-joint*, but, from disease or accident, amputation of the leg be requisite, it may be performed at the joint, without interference with the articular surfaces of the femur or patella. 2nd. If there be *disease* of the *joint*, resulting in ulceration of the cartilages, amputation—when excision is inappropriate—should be completed by removal of the condyles of the femur, and the articular surface of the patella, or the whole of that bone.

The *advantages* of both these amputations at, or just above, the knee-

joint, as compared with removal of the limb higher up, relate to the results of operation, either in regard to the mortality or the kind of stump.

Both operations are *less fatal* than amputation in the thigh, there being less shock, less liability to suppuration, less risk of necrosis, and of osteo-

FIG. 83.



myelitis; the medullary canal of the femur not being opened, in the two former amputations. The results with regard to the *stump* are certainly very advantageous; a long stump is provided for the adaptation, and more convenient use, of an artificial limb; and after the operation with a long anterior flap, the end of the stump is well covered by integument, and thus protected from the risk of excoriation from pressure, as the cicatrix lies altogether behind the surface.

Amputation of the Thigh.—An assistant compresses the femoral artery, or Esmarch's elastic coil is applied sufficiently high up (Fig. 83), as

FIG. 84.



occasion may require; and then, an assistant, sitting on a stool, holds the leg so that the thigh shall be horizontal, and project from the buttock over the edge of a table. The Surgeon with his left hand lays hold of the fleshy part of the thigh in front of the bone, and raises it a little; then, introducing a long-bladed amputating-knife *just in front* of the femur and transfixing the thigh, an *anterior flap* is made by cutting downwards and outwards to the surface (Fig. 84). Entering the knife again, about an *inch lower than the upper limit* of the former incision, and passing it

behind the bone to the same point on the other side of the thigh, a *posterior flap* is made of corresponding length and shape. The advantage of re-entering the knife as directed, is not to jag the integument by the alteration of level necessary to transfix the thigh, in lowering it under the bone. Both flaps should be now retracted by an assistant, the knife swept round the bone at the *highest point*, and the bone sawn transversely across by a light vertical action of the saw (Fig. 85). The *leg assistant*

FIG. 85.



must observe to evenly support the limb, as the bone is divided; not to *lock* the saw by elevating the limb, nor to *snap* and *splinter* the bone by allowing the limb to drop. The *artery* and any muscular branches must then be seized with artery-forceps, and secured by ligature, or by torsion; and the flaps evenly adjusted with sutures.

The *circular mode* of amputation may be preferred, especially in a very muscular thigh (see p. 443).

AMPUTATION OF THE THIGH BY LATERAL FLAPS.—VERMOREL'S OPERATION.—In the lower third of the thigh, amputation is best performed by lateral, instead of antero-posterior flaps; the sides of the thigh, in this part, being more fleshy, and better fitted for the formation of a stump. The Surgeon grasping the soft parts, on the outer side of the thigh, with his left hand, and drawing them outwards from the side of the femur, the *knife* is entered *perpendicularly* in the *middle* of the thigh, about three inches above the upper border of the patella, and thrust downwards close round the bone, and brought out in the centre of the ham; the flap thus being cut downwards and outwards. The knife is again entered, at the upper angle of the incision, the thigh transfixed close to the side of the bone, and the point being brought out at the lower angle of the incision, a corresponding inner flap is made in like manner. Unless the blade be passed around the bone on this aspect of the thigh, the femoral artery is very apt to be split. The flaps are retracted, the bone cleared by a sweep of the knife, and the saw applied about four inches above the condyles.

Amputation at the Hip-Joint.—This operation, so fatal in its results, is less formidable in its performance. The patient lying with his buttock on the edge of the table, an assistant supports and governs the limb; another assistant, standing at the pelvis on the side of operation, compresses the artery above the brim of the pelvis, and is ready to take charge of the vessel when divided in the first incision. Or, the risk of hæmorrhage may be guarded against, by means of the aortic tourniquet. This instrument can only be brought to bear in a tolerably thin subject. For direct compression of the aorta, or either of the iliac arteries, Davy's "rectal lever" answers admirably; the promontory of the sacrum, or the brim of the pelvis, offering the most effectual counter-pressure. The Surgeon, standing as usual with his left hand towards the distal part of the limb, selects the longest-bladed amputating-knife; introducing it—in the *left limb*—about *midway between the anterior superior spinous process of the ilium and the great trochanter*, he thrusts it directly across the joint, so that its point shall emerge *just above the tuberosity of the ischium*, the scrotum being drawn away and protected by an assistant. The knife, thus transfixing the root of the thigh, is carried rapidly downwards and forwards to the surface, cutting an *anterior and inner flap*, about five or six inches in length, and the breadth of the thigh. The assistant at the pelvis, closing his hands into the wound from either side, catches the femoral artery in the under surface of this flap, between his fingers beneath and thumbs over the flap. The limb should now be forcibly *abducted and everted* by the leg assistant; the *capsule* opened from the inner side by drawing the *knife firmly across*, when, with a *touch on the round ligament*, the assistant depressing the limb, the bone starts from its socket. The blade is then laid on, about its middle, behind the head of the femur, the *remainder of the capsule divided*, and by drawing the knife *downwards and backwards* through the muscles, a *shorter posterior flap* is fashioned to meet the anterior one. The *artery* and any muscular branches having been secured, and the large cavity well sponged with cold water, the two flaps are brought together with sutures, and a *large compress* applied. On the *right limb*, the operation is the same, only that the knife is *entered in the reverse directions*; namely, just above the tuberosity of the ischium (Fig. 86).

FIG. 86.*



By the same mode of operation, also, the femur can be sawn through *below the trochanters*, in fracture of the shaft high up, or disease affecting the shaft below; thus leaving the head and neck of the bone, with ample flaps to cover.

* The knife is represented as transfixing the thigh in the posterior, instead of the anterior, line of flap.

JORDAN'S AMPUTATION.—Amputation at the hip-joint can be performed very readily, after the method devised by Mr. Furneaux Jordan. A *vertical incision externally*, commencing from *just above the great trochanter*, is carried down along the shaft of the bone, to about the *middle of the thigh*; the *shaft* is then freed from its muscular attachments—keeping the knife close to the bone; then the *capsule* of the hip-joint is opened, and the head of the bone disarticulated; and *lastly*, a *circular sweep* of the knife *around the thigh* severs the limb. Before thus completing the amputation, it may be desirable to draw up the skin, as in a circular amputation, and then cut the muscles across; but the muscular retraction is often so considerable, as to allow the integuments to fall over below.

The operation, as thus performed, is specially *advantageous*, for the avoidance of hæmorrhage and the prevention of shock. The wound admits also of free drainage.

This method is applicable whether amputation at the hip-joint be necessary in cases of injury, or of disease, affecting the upper part of the thigh; except where the soft parts cannot be freely left, as in malignant disease.

The long, pendulous mass of flesh, forming the stump, soon retracts, until the longest thigh becomes a short one. Additional firmness may be given to the stump, by *sub-periosteal* excision or enucleation of the femur; the detached periosteal sheath acquiring a notable thickness, and firmness, if not producing bone, as a central pillar of support in the stump.

Jordan's method of amputation at the hip has the additional advantage, over the flap operation, of being adapted for the purpose of *exploration*, by means of the external vertical incision; in necrosis, a sequestrum can then be removed, or excision of the hip-joint performed; or the operation can be at once converted into an amputation, by the circular sweep below to sever the limb.

DIVISION II.

INJURIES AND DISEASES OF ORGANS AND REGIONS.

THE HEAD.

CHAPTER XXXVI.

INJURIES AND DISEASES OF THE SCALP, CRANIUM, MEMBRANES OF THE BRAIN. BRAIN-SURGERY.

Injuries of the Scalp.—Wounds.—The integument covering the skull is liable to wounds resembling those of the soft parts in any other situation. Scalp-wounds may therefore be *incised*, *punctured*, or *lacerated* and *contused*; and these lesions are of very common occurrence. They have two peculiarities worthy of notice—a marked tendency to *heal* by *primary adhesion*, however extensive the wound and detachment of the scalp from the pericranium; and, on the other hand, a special liability to the super-vention of *erysipelas*, suppuration, and sloughing. The favourable character of these wounds seems owing to the greater vascularity of the scalp as compared with the common integument; the unfavourable character alluded to seems to be of constitutional origin, erysipelas of the scalp occurring only or chiefly in persons of “broken” constitutional health.

TREATMENT is the same as that of wounds in general; but the circumstances referred to encourage the attempt to *always* solicit union of the scalp, even when extensively incised or lacerated, and detached; and yet render doubtful the issue of even the slightest scalp-wound. Any hæmorrhage may be arrested by compression, or, if necessary, by torsion or ligature; but the bleeding usually ceases by sponging with cold water. The integument around the wound should be shaved, and cleansed of any hair, grit, or other foreign body; then laid down and replaced, and the lips of the wound neatly brought together; strips of adhesive or isinglass plaster being used to retain them in position, aided, if requisite, by a wire suture here and there. Care should be taken, that the *lips* of the wound be *not inverted*, lest the growth of the hair-stumps should interfere with union taking place. A *capelline*, or other form of head-bandage, may be applied. In the event of *suppuration*, bagging must be prevented by giving a free vent to the matter from the wound, or by an early counter-opening in the most dependent part, or by means of compresses properly applied. With *erysipelas* or diffuse cellulitis supervening, incisions will be

Extravasation may occur in either of three situations: (1) in the skin and the tendinous expansion of the occipito-frontalis in the loose cellular texture under this muscle; or, (2) beneath the cranium, or periosteum. In either situation, the blood may be more or less circumscribed more or less in a cavity.

Contusion of the scalp is liable to involve the subjacent bone, thence the consequences of this additional injury; osteitis, which may result in chronic thickening of the bone. More extensive inflammation is followed by sloughing of the scalp, with exposure of bone, or inflammation of the diploe, which gives rise to infection. This latter result may ensue without exposure of bone, sloughing of the integument; the soft swelling of suppuration of the scalp—known as Pott's "puffy tumour"—being produced, instead of suppurative abscess, or taking its place as a mixture of blood and pus.

The TREATMENT of extravasation is in no way peculiar. When it is taking place, it may be promoted by cold evaporating lotions to check further effusion. Persistent and increasing extravasation

in newly born children; in consequence of pressure during parturition, or in delivery by obstetric forceps.

The pathology of a blood-tumour thus produced, is much the same as that arising from an ordinary contusion of the scalp; the blood collecting beneath the tendinous aponeurosis of the occipito-frontalis muscle, or beneath the pericranium.

SUBAPONEUROTIC cephalhæmatoma presents a bag of blood, of *soft fluctuating consistence* and some size, with a rather hard boundary, situated over the *eminence* of one of the *parietal* bones. This blood-tumour is not peculiar to newly born infants; it occurs also, and perhaps more frequently, on the head in children, as caused by a fall or a blow. But it is the more common form of tumour.

SUBPERICRANIAL cephalhæmatoma has sufficiently distinctive characters. The blood-tumour is still *soft* in the *centre*, but *circumscribed* by a *firm, raised border or margin*, giving a relatively depressed appearance to the centre, or which feels hollow when the finger is inserted. The whole condition might be mistaken for a depressed fracture, with the adjoining margin of bone. But there are no brain-symptoms; and perhaps the bone can be felt at the bottom of the depression. This species of blood-tumour, like the preceding, usually occurs on the *parietal* bone. Valleix has shown that the extravasation of blood, situated between the pericranium and bone, is surrounded by a deposit of osseous and plastic matter, forming a hard ring around the blood; and that the inner aspect of this ring is almost vertical, while the outer aspect inclines down to the adjoining surface of the skull. This plastic boundary is adherent both to the bone and pericranium; but, except a covering of plastic matter, these parts have otherwise a healthy appearance. From Sir James Simpson's observations, it seems that the plastic deposit may become ossified, forming a *plate of bone* on the under surface of the pericranium. Then, the tumour yields a *crackling sensation*, like *parchment*, when pressed with the finger. **Subpericranial cephalhæmatoma** is met with only in new-born infants; at least, such is the generally received opinion. Any such tumour, occurring at the time of birth, is far more frequently found in male than in female infants; and perhaps more often in first parturitions.

TREATMENT, with reference to *subaponeurotic cephalhæmatoma*, should be conducted as for the management of ordinary scalp-contusion and extravasation of blood; but the *subpericranial* form of blood-tumour will subside, naturally, in the course of time. *Compression*, uniformly applied to the tumour, may, however, aid absorption.

Injuries of the Cranium.—Contusion of the Bone.—Cranial contusion is produced by, and accompanied with, a wound or contusion of the scalp; but it is unconnected with fracture, as being simply a contusion of the bone. It may arise from a fall or blow, of no apparent severity; or from slight gunshot injury, as the brushing abrasion of a spent bullet, striking the head obliquely, and removing perhaps only the hair. Yet the consequences may be very serious or fatal.

CONSEQUENCES.—(1.) It may give rise to *osteitis*, resulting in *caries* or *necrosis* of the contused bone, affecting one or both tables of the osseous substance; and limited to the seat of injury, or spreading far and wide even over the whole vault of the skull. In a case related by Saviard, after a blow on the head, the whole skull-cap came away.

whenever, from any exciting cause, aggravated.

Symptoms.—Tenderness, and perhaps both of a *persistent* character, over the external signs of this chronic inflammation.

Treatment consists in topical depletion of the scalp over the affected portion of the skull, by the repeated use of *blisters*, with a course of *Trephining* the bone has been resorted to in cases of cerebral irritation; but the result has seldom been successful to justify the risk in such cases.

(3.) *Inflammation* of the *diploe* is a form of such inflammation extending probably to the *detachment of that membrane* and *suppuration*. Thus far the mischief is circumscribed to the arachnoid membrane, it spreads to the visceral layer; thence to the surface of the brain. *All the membranes* of the pericranium or periosteum separates, *the scalp*, giving rise to a boggy swelling prominent—the “puffy tumour” of Pott; *its healthy florid* appearance, its edges become discoloured, thin, and gleety, while the bone, or the latter, if *denuded*, becomes discoloured. In removing the dressing the surface, instead of coming off, as fragments of bone undergoing necrosis, becomes a mass of sawdust from the outer table is quit a greenish, viscid, and putrescent fluid. The structure are thrombosed, coagula co-

and hemiplegic or local forms of paralysis may also be appre-

Pyæmia is apt to arise as a fourth consequence of contusion of the bones, and usually in conjunction with a wound of the scalp. A lacerated scalp-wound, which removes the periosteum from one of the skull, and thus exposes the bone, without contusion, is of head injury very apt to induce osteitis and consequent pyæmic inflammation. But contusion, with denudation of the bone, is even a more serious injury. Pyæmia from cranial osteitis, however caused, may occur in one of two ways, or both may be combined; sometimes in connection with intra-cranial suppuration; commonly with suppuration of the diploe, the membranes of the brain remaining unaffected, and the veins of the skull being the source of purulent infection. Commencing about ten days after the injury, its accession is marked by *rigors*, which recur, not periodically, with greatly increased *rapidity of pulse*, and *fever*.

It is very important to bear in mind these four consequences of other than fracture injuries of the head:—death of the bone; or perhaps chronic inflammation of the diploe, and its associated inflammation of the membranes of the brain, with intra-cranial suppuration; and pyæmic

Treatment for inflammation of the diploe from cranial contusion should be given in conjunction with Fractures of the Vault of the

Effects of the Brain.—Concussion.—Literally signifying a more or less severely, this also is the pathological meaning of brain concussion. Concussion of the brain is a shaking of the

of the brain may be discovered after death. But in the most, instantaneously fatal, appreciable lesions are to be found in the form of extravasated blood, numerous scattered, or circumscribed foci of contusion or bruising, on, or in, the brain-substance.

In concussion, not immediately fatal, where life continues for a few hours, another result is found;—intense congestion of the cerebral vessels and permeating the whole brain-substance; without any actual lesion. This pathological condition is due apparently to a paralysis with relaxation of the vessels, the vaso-motor influence suspended.

Slight concussion, followed by reaction and recovery, is probably accompanied with similar injury to the brain and congestion; varying only in degree and having no definite proportion to the previous symptoms of concussion.

Symptoms.—The symptoms of concussion of the brain are, essentially, *loss of consciousness*—comprising a suspension of all the functions of the brain, as the direct and immediate effect of the injury. The person is insensible. Three degrees of this state are now commonly recognized—(1.) *Simple concussion*; with momentary loss of sensibility and muscular power; with depression of the circulation, as denoted by a feeble, but commonly rapid and rapid, pulse at the wrist. These symptoms soon pass off, the patient comes to again, and proceeds about his business as if nothing had happened, retaining, often, no knowledge of the injury. (2.) *Complete*

only returns; the patient can be roused to answer a question in a moment of manner, and then relapses; or he may get out of bed and lie down again,—as if possessing the power of voluntary action, yet be in a state of concussion-sleep, even when spoken to loudly. In some cases, however, the patient awakes, and the reaction supervenes as a symptom of *reaction* and recovery, and the symptoms of concussion gradually pass off in a few hours or days. In some cases, however, headache, confusion, and giddiness remain; or symptoms of inflammation supervene. (3.) *Complete* insensibility, and death *perceptible*. No reaction follows, and death takes place in a few hours.

The fall of *temperature* is no measure of the amount of brain injury. In simple concussion, half an hour after such injury, the temperature falls to 93.5° , according to Mr. Le Gros Clark's observation; yet the patient recovers. This reduction of temperature contrasts with the rise of heat, under *compression* of the brain.

The CAUSE of cerebral concussion is, of course, external force applied directly to the head, as by a blow or fall; or indirectly, through some other part of the body, as when a person falls from a height alights on his feet. Force, in either way, having been applied to the brain, is partly diffused through its soft substance; but the part struck is isolated by the arachnoid sac, is driven from the part struck to the opposite wall of the cranial cavity, and thence rebounds back, diminished force, by counter-stroke—*contre-coup*. Successive vibrations thus vibrating through the brain continue the shaking until the brain regains the state of rest. The force of concussion is broken up by the cushion of the arachnoid sac, and by the membranous septa of the mater within the cranial cavity.

CONSEQUENCES.—1. *Intra-cranial extravasation* of blood is the most immediate occasion of peril, during reaction from concussion. Thence the *symptoms* of *compression* are apt to arise. *Passive* extravasation, arising generally from injury of the meningeal arteries or of some of the venous sinuses, is charac-

concussion, and, in the latter form of the disorder, after an interval of good health.

The approach of *chronic* inflammation may be very *insidious*, and its effects permanent, in the impairment or loss of various cerebral functions. The memory fails with regard to places or persons, dates, or the relation of certain words. The special senses become impaired, as by blindness, with paralytic falling of the upper eyelid,—ptosis, or squinting; one or both eyes may be affected. Loss of hearing is sometimes experienced, or various disturbing sounds in the head are heard, and smell or taste may be perverted. Headache, more or less persistent, and sleepless, with horrible dreams complete the misery of these purely cerebral affections, and paroxysms of maniacal excitement are apt to be induced by slight indulgence in drink, or by any other occasion of cerebral excitement. The muscular strength declines, and the sexual power becomes reduced; while the general health, as depending on innervation, is reduced. The patient brought to a cachectic, broken state, the very shadow of his former self. Strange to say, the pulse may remain unaffected, or only slightly slow, as if not indicative of any inflammatory mischief in the system, and this seems to be more particularly observed when the base of the brain is the seat of such morbid change, as declared by the character of the other functional symptoms.

Suppuration, as a consequence of inflammation, will give rise to symptoms of *compression*. But this takes place at a later period than the occurrence of intra-cranial hæmorrhage after concussion, thus aiding the diagnosis of the two causes of compression.

TREATMENT.—The pathology of concussion supplies two general indications of treatment; namely, to prevent increasing congestion or the tendency to inflammation, and to give time for the cerebral lesions to recover themselves.

1. Hence, in the *stage of depression*, or *insensibility*, interference should be little, and judicious—on the one hand, not to increase congestion by blood-letting or other reducing measures; on the other hand, not to increase reaction and the tendency to inflammation, by over-stimulation. Stimulants should be administered in proportion to the depression and its duration, as evinced by the temperature and state of the pulse. But, in complete unconsciousness, there will be the risk of suffocation, in any attempt to excite the act of swallowing; the stomach-pump should then be resorted to, and whatever stimulant may be requisite. Other measures may also be employed with advantage; such as a turpentine enema, hot-cups to the feet and in the axillæ, with perhaps a mustard poultice to the gastric region. It should be remembered that, while slight depression is followed by slight reaction, extreme depression will be succeeded by extreme reaction, and this would be aggravated by over-stimulation previously. 2. In the stage of *reaction*, interference should be regulated by the same, as often bordering on inflammation. An elevated position, with attention to the head, shaved for its application, are the best safeguards. A solid diet and abstinence from stimulants, coupled with the administration of gentle, watery *aperients*, will effectually keep the circulation in the proper channel.

Any tendency to relapse must be watched at the same time, and prevented by recurrence to stimulating treatment.

Complete rest and the withdrawal of all surrounding circumstances of excitement are imperatively *necessary* to recovery. A quiet life should

substance also.

Concussion of the whole brain may be produced by a shaking of the cerebral matter and blood-vessels, being a necessary consequence of a fall or blow on the head, which should produce a localized disintegration of the brain matter, a mere fissure, without displacement; so that this lesion cannot be attended by any symptoms.

The *situation* of contusion may be on the surface—direct contusion, or disintegration by *contre-coup*. The middle and deep layers, under surface, are more frequently broken.

The SYMPTOMS are unconsciousness, stertorous breathing; tonic spasms of the limbs, tossing about in bed. But these symptoms are not necessarily dependent on cerebral contusion, but are symptoms of its own. They have been considered as a primary form of cerebral distension. *Paralysis* is produced by contusion of one hemisphere; the paralysis being on the opposite side, involving both motion and sensation, and the fifth nerve. There is inability of the face to one side is rarely marked. The sound hemisphere. The pupils are unequal, no strabismus.

Inflammation of the brain is very common after contusion; this change being denoted by a change from raving delirium, succeeded by coma.

TREATMENT—apart from that for the absorption of extravasated blood, and the relief of the symptoms.

a stertorous or snoring noise, owing apparently to paralysis of the palati, and a puffing blowing of the lips; this sound dying away and then, it may be succeeded by a sort of catch in the throat, with a relapse into deep snoring; the pupils are dilated, sometimes contracted, or one may be contracted and the other dilated, but they are always sensible to light, the eyes perhaps upturned, or with a squint inwards or outwards; and the pulse is slow and full. The fæces may pass involuntarily, the urine be retained, or dribble away. Hemiplegia often occurs, and on the side opposite to the seat of compression. This general state is sometimes varied by attacks of delirium or convulsions. The temperature is raised, or the fall registered is less than in concussion.

DIAGNOSIS.—1. The distinction between cerebral compression and concussion has been generally determined—mainly by the three symptoms of breathing, the state of the pupils, and the pulse, to which may be added relative temperature, as already described with reference to each of the conditions of the brain. But in intervening states of cerebral injury, diagnosis is equivocal. Sir Prescott Hewett affirms that “there is no symptom, or combination of symptoms, which will enable us to determine positively between concussion and the slighter cases of compression.” The coma arising from any cause of cerebral compression may be mistaken for the more or less complete insensibility of *drunkenness*—when the person is said to be “dead drunk,” or “stupidly drunk;” an error of diagnosis so very unfrequent in the casualty-room of Hospitals, and in surgical divisions at police-stations. The condition in question may be distinguished partly by the *absence* of any *injury* to the head, unless the person has fallen down or been struck on the head, when drunk, as sometimes happens; but the Surgeon should also judge by the smell of the breath, or by suspicion that the person has been drinking. In the course of a few days, intoxication will pass off, thus more clearly declaring the nature of the case. 3. *Delirium tremens*, with some injury to the head, must not be overlooked in the diagnosis of occasional contingencies. But the symptoms of drunken delirium supervene *after* those of the head-injury which may have induced the attack. 4. *Apoplexy* is another condition which might be mistaken for the Surgeon. But the *turgid lividity* of the face, and the absence of any injury to the head, unless accidental, will be sufficiently distinctive; though the former appearance be associated with a dilated state of the pupils, a stertorous breathing, and laborious pulse, as the symptoms of cerebral compression. In either of the cases referred to, drunkenness or apoplexy, the accidental concomitant of head-injury should lead to further examination; for no injury short of fracture with depression can cause any immediate symptoms of compression. Then, indeed, the diagnosis will be possible; both the co-existing conditions being productive of coma. 5. Insensibility which arises from poisoning by *opium* may be yet another source of some doubt as to the nature of the case. But a very distinctive symptom is the *contracted*, instead of the dilated, state of the *pupils*; and every surgeon should be made respecting the probability of attempted suicide. Also, the use of the *stomach-pump* will both determine the question of diagnosis, and be a preferable mode of treatment to the administration of an emetic; the bare possibility of apoplexy being the cause of coma would render it unadvisable to run the risk of aggravating such an attack by the act of *vomiting*.

The CAUSES of compression agree in their general nature; they are all some source of pressure on the brain. They vary in being—a depressed fracture, or other impacted foreign body; extravasated blood, or a collection of matter, within the cranium. Two such causes may co-exist, as depressed fracture, with extravasation of blood; or all may co-exist, as intra-cranial suppuration, with depressed fracture, and extravasation. Besides causes of traumatic origin, compression may result from apoplexy, or the growth of intra-cranial tumours.

CONSEQUENCES.—*Inflammation of the brain, or its membranes, is equally liable to follow, as from concussion, although the cause of compression will affect the probability of this event. Depressed fracture inevitably leads to inflammation, and intra-cranial suppuration presupposes it. Death results from continued compression, in a period varying with the degree of pressure, and the functional importance of the part of the brain affected.*

TREATMENT.—Obviously, the compressing cause must be removed. This implies a different mode of proceeding according to the particular cause in operation.

The head should be shaved and carefully examined. (1.) *Depressed fracture* will probably necessitate the elevation of the depressed portion of bone, by means of an elevator, or its removal, by *trephining*. The conditions which justify these operations will be enumerated in the Rules of Treatment pertaining to Fractures of the Cranium. The question of removing a foreign body, as the cause of pressure, will be noticed in connection with Trephining. (2.) *Intra-cranial extravasation of blood* can, generally, be treated without recourse to operative interference. The compressing cause is the same as that of apoplexy. Hence, the extravasation of blood may be arrested and reduced, by *cold* applications to the head, and by the depletory action of *purgatives*. No form of purgative seems to act so speedily and impressively on the brain, as a turpentine enema; say, an ounce of turpentine to a pint of gruel, the strength which I am in the habit of ordering. Its beneficial influence should be aided by *bottles of hot water* to the feet. Cupping on the nape of the neck, or even venesection, may be had recourse to, as indicated by the fulness, hardness, and jerking character of the pulse. The operation of *trephining*, to relieve compression from extravasated blood, may be a justifiable procedure, when the situation of the injury, or the existence of a fissured fracture, indicates the probability that a large artery, such as the *middle meningeal*, is involved, accompanied with compression-symptoms. But, the operation may prove abortive, extravasation having occurred on the opposite part of the brain to the seat of fracture,—as if by *contre-coup*. Nor, again, can the seat of intra-cranial hæmorrhage be determined by the symptoms of compression—whether the extravasation be sub-cranial, in the substance of the brain, or into the ventricles. (3.) *Intra-cranial suppuration* is always a question of considerable difficulty as to its existence and situation. This will be considered, and the necessity of having recourse to the operation of trephining, in describing Traumatic Inflammation of the Membranes of the Brain. In the state of coma, from whatever cause, the urine should be drawn off with a catheter, two or three times in the twenty-four hours.

Fractures of the Cranium.—(1.) *Vault of the Skull.*—Fracture

any part of the vault may be: 1. SIMPLE Fissure, or a *comminution* of one; the former is generally not limited to the seat of injury, perhaps passing through various bones, and often extending from the vault into the base of the skull; the latter, or Comminuted Fracture, is commonly limited to the seat of injury,—although such fracture may be extensive as in the cranial smash, or *écrasement*, so named by French authors. Simple and Comminuted Fracture sometimes *co-exist*, and especially when caused by a heavy blow acting on a large surface. *Incomplete* fracture, *i.e.* limited to the external or internal table *alone*, has been known to occur, but comparatively rarely.

DEPRESSED Fracture; the displacement of the bone being *inwards*; *inwards*, very rarely. Either form of depressed fracture is often *Compound*; and the former, or inward depressed fracture, may be a *stellate* or perhaps stellate fracture, when it is necessarily comminuted, larger portions of the internal table being driven in. Traumatic depression of the skull, *without* fracture, is not authenticated by any specimen. In the adult, the existence of such injury cannot be acknowledged; and in the child, with pliant bones, some of the bony fibres must be broken, forming an *Indented* fracture.

Displacement *inwards* may affect the external or internal table *alone*. The *external* table may be driven down in any part of the vault, but especially in the region of the frontal sinuses, where the depression may be extensive, without any injury of the inner table. In *childhood*, when there is no diploe, depressed fracture of the external table alone can only occur over the frontal sinuses, or into the mastoid cells. From gunshot wounds, the outer table may be grooved, as by the angle of a shell fragment or a spherical ball. 2. The *inner* table may be broken and depressed without any trace of injury about the outer parts of the bone. Fracture of the *inner* or vitreous table is always much more extensive than that of the *external* table,—a very important fact in relation to the operation of trepanning.

Displacement *upwards* of both tables is sometimes produced by fracture from within the skull, as in suicide by firing a pistol into the mouth.

COMPOUND Fracture.—A wound of the integument, leading down to the bone, may accompany every variety of fracture of the vault. But the extent of the bone is very much more frequently strictly limited to the seat of the blow than in simple fracture.

The *accompanying* lesions of fracture in the vault of the skull are various. In addition to *wound* of the scalp, occipito-frontalis muscle, and pericranium or periosteum, *extravasation* of blood may take place beneath any of these integuments—parts external to the vault of the cranium. *Extra-cranial* extravasation is found in one, or more, of three situations: between the scalp and the tendon of the occipito-frontalis muscle, between that muscle and the pericranium, or between that membrane and the bone. The skull, brain, and its membranes may be severally similarly involved, as extensions of the fracture-injury to the contents of the cranial cavity. These effects are produced, principally, by depressed fracture. They are separation of the dura mater from the interior of the cranium, wound of this membrane, of the arachnoid, pia mater, and laceration of the brain; *extravasation* of blood in the diploe of the skull, or *extra-cranial*, namely, between the bone and dura mater, or into the

cavity of the arachnoid, or beneath the arachnoid and in the pia mater, or into the substance and ventricles of the brain.

The source of *hæmorrhage* varies. Extravasation between the bone and dura mater may proceed from the *small vessels* passing from one to the other, or from some of the large vessels lodged in the grooves on the inner surface of the skull. The former extravasations are, generally, of small size; but the latter may be very extensive, widely separating the membrane from the bone over the greater part of one side of the skull. The *middle meningeal artery* is the source of these large extravasations, in the majority of cases. One of the large *venous sinuses* may be the source of extravasation, and the lateral sinus more commonly than any other sinus.

CAUSES.—*Direct violence* is almost invariably the *only cause* of fractures of the cranium in its vault, an etiological distinction as compared with fractures of the base. Falls on the head, and blows with almost every kind of weapon, or gunshot injury, as a bullet-wound, represent the occasions of direct violence.

In *punctured* or *penetrating* fractures of the skull, the injury may be caused by a sharp-pointed instrument, as a spike or bayonet, or by a bullet in gunshot wound. The relatively greater size of the *aperture of exit*—in either table of the skull, as the case may be—is an important fact; whether from a surgical point of view, or with reference to medico-legal inquiry.

SYMPTOMS.—*SIMPLE Fracture*, in any form, is not accompanied by symptoms or signs invariably and exclusively indicative of this kind of injury. *Fissure* may exist, undiscovered during life; and a *comminuted* fracture, with great depression of the fragments, may be concealed by the temporal muscle, or by a large extravasation of blood. On the other hand, either a circumscribed extravasation of blood, or an abnormal depression of the bone, is apt to resemble fracture with depression. An abnormal depression of the skull is congenital, or slowly produced by absorption of the diploe and attenuation of the tables, as sometimes occurs in advancing years.

COMPOUND Fracture more readily admits of detection, by gently passing the finger or probe under the scalp; care being taken not to mistake any natural suture or vascular groove for fracture-fissure. Any abnormal disposition of a suture would be especially misleading. Sometimes, the bone is *scratched* rather than fissured; the lesion being limited to the outer table or perhaps involving the diploe, and extending in length so far as the attrition of the hard substance which produced this lesion. But it is always accompanied with severe contusion of the bone, and the consequences therefore are more serious than a compound fissure, or even with some depression. The *cerebro-spinal fluid* has been known to escape, as a clear, watery discharge, from the wound, in compound fracture of the vault of the skull; but then the injury must have involved the membranes of the brain,—extending into the subarachnoid space, between the arachnoid and pia mater, or even communicating sometimes with one of the lateral ventricles.

Simple, and Compound, Fractures are generally attended with symptoms of *Concussion* of the brain, from the violence causing the injury; although a blow or fall on the head, *without fracture*, may give rise to the same

symptoms. The cerebral functions of consciousness, sensation, and voluntary motion are suspended, more or less completely; the patient is stunned; this state being transient, or of some duration, or soon terminating in death.

DEPRESSED Fracture is *generally* accompanied by the symptoms of *Compression* of the brain; namely, more or less complete suspension of the cerebral functions of consciousness, sensation, and voluntary motion. But other symptoms present differences of character from those of *Concussion*, which are more or less diagnostic;—the breathing is slow and heavy, attended with a stertorous or snoring noise; the pulse is slow and laboured; while the pupils of the eyes are generally dilated, and always insensible to the stimulus of light. *Exceptions* to the general rule are, however, met with; depressed fracture occurring sometimes without any symptoms of compression. Thus, when the depressed bone is not firmly fixed, or, in the case of a loose, comminuted fracture, there may be no cerebral compression; and possibly, only the external table may be depressed into the cancellated texture of the diploe. In *children*, the more yielding and elastic texture of the bones may permit of an indented fracture, without symptoms; the bone soon regaining its proper level. In any uncertain case, *with* cerebral symptoms, the Surgeon will be warranted in making an exploratory incision.

Diagnosis.—The same compression-symptoms may proceed from *extravasation* of blood, or from the formation of *purulent matter*, under the cranium. With depression, these symptoms are immediate; with extravasation, there will be an *interval*,—probably of short duration, during which consciousness may have been regained more or less completely, as concussion passes off, ere the symptoms of compression supervene *gradually* and progressively; with pus-formation, there will also be an interval, during which *inflammatory* symptoms were present, those of compression supervening.

But, in practice, the Surgeon will often look in vain for any well-marked differentiation of concussion and compression; the symptoms of the former state passing into those of the latter, and both being complicated by the cerebral disturbance due to shock. During also the influence of anæsthesia, I have noticed the placid breathing of concussion become profoundly stertorous.

Inflammation, with lymph and pus-formation within the Cranium, is *always* liable to supervene, in consequence of Fracture, and in the same situations as intra-cranial extravasation may occur; namely, in the diploe of the skull, between the bone and dura mater, in the cavity of the arachnoid, beneath the arachnoid and in the pia mater, and in the substance of the brain.

Symptoms of inflammation affecting the *bone*, the *membranes*, or the *brain*, are followed by *symptoms of Compression*, as lymph and pus-formation take place. The symptoms, therefore, run their course in *two distinct stages*; *cerebral excitement*, followed by *stupor* from compression. The patient complains of headache, becomes restless, and feverish,—as denoted by a rapid, bounding, hard pulse, and hot, dry skin. Contraction of the pupils, with intolerance of light and sound, may also be noticed. Soon, wandering or delirium sets in, sickness, and perhaps convulsions; but the agitation of manner, the wild, glistening eyes, with injected

conjunctivæ, flushed face, and throbbing carotids, alike betoken the excited state of the cerebral circulation. The second stage presents a singular contrast; drowsiness, stupor, and coma, with stertorous breathing, a slow, labouring pulse, and dilated state of the pupils, together indicate that effusion has supervened, and compression of the brain; which may be attended with paralysis, convulsive twitchings of the voluntary muscles, and relaxation of the sphincters. Rigors announce suppuration.

"The slow 'cerebral pulse' is generally associated with good arterial tone, and is non-dicrotic, the arteries being contracted rather than relaxed. The systole is of normal length; it is the diastole that is prolonged."

Pyæmia, consequent on fracture of the skull, is mostly connected with inflammation and suppuration of the diploe, implicating some of the numerous and large venous sinuses in the bone.

Necrosis and exfoliation not unfrequently result from gunshot fracture, affecting the outer table alone, or involving the whole thickness of the skull, and even extensive portions of bone have been detached.

Repair.—Fracture of the vault of the skull may undergo repair, either by ossific union, or by the formation of a membrane which becomes the seat of ossification,—thus closing in a large aperture.

TREATMENT.—Fractures of the skull assume importance, wholly in their relation to *brain-symptoms*; whether by the concomitant cerebral Concussion, or from Compression,—as arising from a depressed fracture, or owing to the supervention of intra-cranial extravasation of blood, or inflammation, leading to effusion and suppuration.

1. **CONCUSSION** is naturally followed by reaction; and although, pathologically speaking, there may be an interval, of however short duration, between the occurrence of fracture with concussion, and the supervention of extravasation, yet the insensibility arising from the former stage often merges into that of the latter. In practice, therefore, the Surgeon cannot be too cautious not to provoke extravasation, by the injudicious use of *stimulants*. *Warmth* to the surface, by enveloping the patient in blankets, with bottles of hot water to the feet, and in the axillæ, will prove sufficient; except in cases of extreme depression of the circulation. Then, watching the restoration of the pulse, attention should be directed to the prevention of *extravasation*, by the prompt adoption of repressive measures. It will be better to err on the safe side of early interference. The patient's head should be shaved and elevated; and the circulation reduced by the application of an *ice-bag* to the *head*, coupled with the depletory action of *purgatives*. I believe an enema of turpentine and gruel to be most efficacious; acting partly as a derivative from the brain. Blood-letting should be had recourse to as the pulse rises *towards* high reaction, with the view of keeping the circulation in check, but not so as to throw the patient back into a state of depression. Extreme depression of the circulation is succeeded by extreme reaction; and hence the propriety of very cautious administration of stimulants, and timely recourse to blood-letting; either measure being indicated and regulated by the state of the pulse. Venesection will make a more decided impression on the general circulation, than cupping on the nape of the neck.

When extravasation does not occur,—when the patient does not lapse again into a state of insensibility,—with reaction from concussion, congestion of the cerebral vessels often remains; and thence the liability to

cial inflammation. The same precautionary measures must still be taken towards keeping the circulation in check. *Cold* to the shaved scalp, *depleto*ry *purgation*, with a moderate diet, and perfect rest, may prevent the development of inflammation. On the accession of the first symptoms—headache, sleeplessness, and feverish excitement—then, again, *bleeding* will become a justifiable resource; the Surgeon still watching the general effect, not so much on the pulse, as in relation to the brain. Topical bleeding may suffice, by leeches to the temples, or by scarification on the back of the neck; or venesection, by small and repeated cuts, rather than one large loss of blood. A depletory and sedative regimen the circulation may be maintained by antimonial salines; while a small-fashioned pill of calomel and opium will certainly prove beneficial, as its influence is carried to slight salivation. Subsequently, a counter-irritation from the head should be secured by *blistering*, dressed with a mercurial ointment; while *tonic* and supporting measures are gradually resorted to, to renovate the general health.

COMPRESSION.—The question of *Operative* interference turns partly on the presence, or absence, of Compression-symptoms; but principally on the presence, or absence, of Compound fracture—a wound leading to the fracture.

Linear fracture or fissure, unaccompanied by brain-symptoms, even if compound, should not be interfered with; the wound must be dressed according to circumstances, and the case carefully watched for some time.

Unminuted fracture, even with depression of the fragments, but unaccompanied with symptoms and a wound, should not be interfered with. It is now an established rule, that *Simple* fractures, with depression without symptoms, are to be left alone. The depression may be so slight as to be easily detected; but so long as there are no symptoms, no operative interference, of whatsoever kind, should carefully be avoided. The Surgeon, with unlimited faith in "antiseptic precautions," but with limited success in fractures of the Skull, would operate, as if the whole significance of Head-injuries was the liability to septic infection—even allowing for the chance of its prevention in all cases.

Compound fracture, with depression, although unattended with symptoms, justifies recourse to operation, and without delay—to prevent cerebral suppuration consequent on this condition of fracture. On the other hand, the presence of symptoms in this condition of fracture is a strong warrant for operative interference, in the experience of a few Surgeons.

It is the "question of operative interference" in Fracture of the Skull, should turn principally on the *Compound* or *Simple* nature of the fracture—whether depressed or not, and with or without compression-symptoms; the admission or exclusion of air—according to the mode of injury—alone determining whether or not the Surgeon should elevate the depressed bone, and thus remove compression, or remove an undepressed fragment of bone, to prevent the otherwise almost inevitable accumulation of blood as a consequent cause of compression.

Enfractured fracture—sharp splinters of the inner table being driven into the brain without symptoms—most imperatively demands operative inter-

Certain *exceptional conditions* of ordinary compound fracture may be noticed. A *slight depression*, especially when it corresponds to the thicker part of the injured bone, does not require an immediate operation. A deep driving-in of the bone over the *frontal sinuses* is another exception; always remembering that these sinuses do not begin to form until several years after birth. A compound fracture with depression, but without symptoms of inflammation, *some days* after the accident, should not be submitted to operation; and the less so, if the depression is broad, and the fracture comminuted. Such a condition may proceed to recovery without any intra-cranial inflammation.

Thus far respecting Fractures of the Skull *without* brain-symptoms, in regard to their Rules of Treatment.

(2.) *Depressed* fractures, accompanied with primary brain-symptoms, may be thus represented:—*Simple* fracture, with the symptoms not very urgent, justifies the postponement of operation; but if there be urgent symptoms, prompt interference is the rule to be observed.

Compound fracture depressed, and with *symptoms*, assuredly demands immediate interference. It may or may not prove successful, according to the urgency of the symptoms, owing rather to extravasation of blood, or brain-lesion, than depending on the fracture-depression.

(2.) **Fracture of the Base of the Skull.**—Commonly a fissured or radiated fracture, there is little or no displacement, the bones being nearly immovable. The fracture may be situated in either the middle, posterior, or anterior fossa of the base, and generally in this order of occurrence—the fissure passing through the petrous portion of the temporal bone, or into the foramen magnum. Two fossæ may be implicated; as the middle and posterior, or the middle and anterior. All three fossæ may be implicated concurrently; but this happened in only ten cases in ten years.

SYMPTOMS.—The only peculiar and reliable symptoms of fracture of the base are the escape of some of the contents of the skull: *blood*, through the ears, nose, and mouth, or into the orbit; a *serous fluid*, probably the cerebro-spinal fluid, from the ears or nose; or *brain-substance* possibly; accompanied with special symptoms of injury to the cranial nerves as they emerge from the skull. Thus loss of smell or of sight, facial paralysis and deafness, pharyngeal paralysis and aphonia, may severally be indicative of fracture of the base; although the same symptoms may also occur from injury to the brain, without fracture.

Compression-symptoms are often absent with extravasation, in fracture of the base; displacement of the subarachnoid fluid allowing room for the collection of blood, either between the dura mater and bone, or commonly in the cavity of the arachnoid.

But all the symptoms vary with the *situation* of the fracture.

1. In the *middle fossa*, there is probably fracture of the petrous portion of the temporal bone, with rupture of the tympanum, and thence the escape of watery fluid, or blood, from the ear. A copious discharge of watery fluid from the ear, *immediately* after the accident, leaves no doubt that such is the nature of the injury. A copious and prolonged bleeding from the ear, *followed* by a watery discharge, also indicates the same injury—fracture of the petrous bone. Occasionally there may be a collection of this fluid under the scalp; I believe invariably, with injury of the

Corresponding ventricle. 2. In the *posterior fossa*, fracture is more obscure; unless it extend into the petrous bone. But posterior fractures of the base are sometimes attended with extravasation of blood from the large venous sinuses into the cellular tissue of the mastoid region, or at the *back of the head*. 3. In the *anterior fossa*, fracture is attended with extravasation of blood into the *orbit*, thence under the ocular conjunctiva, and eyelids—the lower one first, in most cases. *Hæmorrhage* from the *nose*, also, not unfrequently occurs. But fracture in this fossa may exist *without* any extravasation under the ocular conjunctiva, or with only discolouration of the lids; and then the fracture, however extensive, cannot be diagnosed. Extravasation in both these situations may also arise from fracture of the *superior maxillary* or *malar* bones; and hæmorrhage from the nose may proceed from fracture of the *nasal* bone—a broken nose. The appearance of the eyelid is, however, more likely to be mistaken for that of an ordinary “black-eye,” as if from contusion of the cheek,—a blow or fall on this part. For, whether produced by cranial fracture, or by contusion only, in both cases there is considerable swelling and purplish discolouration, but with this difference: in the one case, the extravasation, being subcutaneous, looks *shaded* by the skin; while the other presents the familiar appearance of blood partly in the skin, as the ecchymosis of a bruise. Bleeding from the nose is also often unconnected with any fracture, cranial or nasal; but may arise from a blow, or other cause of contusion and traumatic epistaxis.

Vomiting of blood occurs, when during hæmorrhage the blood has passed down the pharynx into the stomach. Thus, from fracture in the anterior fossa, the blood may trickle back through the nose into the pharynx; or from fracture in the middle fossa, involving the petrous portion of the temporal bone, so as to open the tympanic cavity, blood may find its way through the Eustachian tube into the pharynx; in either case, the blood being swallowed, it is ejected by an occasional vomit. In such cases, also, some of the blood passing into the nares, adds to the nasal hæmorrhage; or bleeding, as if from the *mouth*, occurs; the blood, not swallowed, is spit up, or may even seem to be expectorated.

A discharge of *brain-substance* is of diagnostic value only in evidence of fracture implicating the cribriform plate of the ethmoid bone,—the discharge being through the nostrils.

The fall of *temperature* in fracture of the base is sometimes remarkable. In one case, with laceration of the brain, under the care of Mr. Le Gros Clark, the temperature fell to 87.4° in one hour and a half after the injury; this being the lowest temperature observed after any injury, as hitherto recorded. Death ensued in nine hours, the temperature having risen barely to 90° just before death.

Fracture of the base—the more common form of fractures of the skull—is very frequently *fatal*. In the event of recovery, no union may have taken place, after months or even years; or union partly by dense fibrous tissue with a thin layer of inlaid bone; or bony union, and throughout the whole line of fracture. In some of the latter cases, porous bone has been found heaped up along the sides of the line of fracture, on the inner aspect of the skull, and even blocking up one of the venous sinuses.

CAUSES.—*Indirect* violence is almost invariably the *only* cause of fracture of the cranium, in its base. A heavy blow, or fall on the top of the

head, is commonly the cause; but a fall, the person alight on the buttocks, may be another mode of indirect violence. In this case, the cranium is compressed between two forces, the one on the vertex and that of resistance by the apex of the skull, or the latter may be driven upwards, as in the case of a fall on his feet.

The production of fracture by indirect violence, at the part struck, is designated fracture by *contre-coup* or *contrecoup*, the cranium yielding laterally, and giving way at the point of least resistance or impulsion. But Dr. Aran's experiments have shown that generally these fractures begin, not at the base, but start at the vault struck, and then stretch round into the base. A fracture of the base of the skull by *contre-coup* would therefore seem to be a rare occurrence. *Direct* violence is, comparatively, very rare in any portion of the base. At certain parts, the bone is soft and brittle, readily yielding to any force directly applied to the orbits, the nostrils, and the occipital fossæ. Sharp-pointed instruments, or a tobacco-pipe, may penetrate the cranial cavity, and also injure the brain. Occasionally, gunshot wounds, as when a pistol is fired into the mouth with suicidal intent, cause, as when a pistol is fired into the mouth with suicidal intent, cause, as when a pistol is fired into the mouth with suicidal intent,

The *accompanying lesions*, produced by indirect violence, arise from its extension to the vessels at the base of the brain, the meninges, and brain, or cranial nerves. Hence, extravasation of cerebro-spinal fluid, or even of brain-substance, may occur, and the nerves emerging from the skull.

TREATMENT.—Fracture of the base remaining without the Brain-lesions alone assume the whole consequence of the injury. regard to the extravasation of blood, or the supervention of inflammation. Hence, the same treatment for Concussion, or for symptoms of inflammation,—whether arising from intra-cranial extravasation, or from inflammation of the meninges, or from inflammation of the brain. Fractures of the Cranial Vault. Trephining has, however, been successfully, close to the foramen magnum.

Separation of the Sutures, or Diastasis, of the skull, of the head, is liable to occur in youth, with or without fracture of the skull. It may take place in the vault of the cranium, at the sutures of the lambdoidal sutures, or in the cranial base; or some of the epiphyses, as between the occipital and sphenoid bones, or the petrous and squamous portions of the temporal bone. It may be to all effects, fractures; and the *diagnosis* of sutures, at the base of the skull will be impossible in practice. The distinction cannot always be ascertained, unless by the more precise examination beneath the integument. The *direction* of the disunion, as corresponding to the *direction* always significant of the kind of injury; especially in the case of a similar swelling of the scalp, arising from venous congestion, or rupture of a sinus under the suture. Or an injury of the bones, the more so if the dura mater be lacerated. A fracture of the cranial bones is usually a *fatal* injury; owing to the necessity to produce separation of the sutures, the free escape of blood, and often of hæmorrhage within the skull, as well as the escape externally.

must be conducted in accordance with the rules already laid down for the treatment of cranial fractures, simple and compound.

hernia cerebri.—Protrusion of the brain-substance is liable to occur through laceration of the brain and its membranes, communicating with a compound fracture of the skull,—as arising from a fall or other violent injury, or from gunshot injury. The projecting portion of brain not covered by the meningeal covering is not, properly speaking, a hernia, and is designated *fungus cerebri*. It may present itself in any part of the brain, commonly in some part of the vault, and especially the cerebral regions. It rarely occurs at the base of the skull; when it does, it is then being forced through the ear, nose, or possibly into the mouth.

The appearances are those of brain-substance, more or less modified; the colour is more or less bloody character. Nerve-tubules, with the meninges, may be discovered under the microscope. The appearances, as well as the microscopic characters, will distinguish brain-substance either from a collection of blood products, from pia mater, or exuberant granulations from the brain. *hernia cerebri* is *continuous* with the brain.

The cause of *hernia cerebri* would seem to be the loss of a portion of the brain in fracture of the base—and compression of the brain, with inflammation, with the effusion of lymph and pus, or from the effusion of blood, or perchance the presence of a foreign body. The brain becomes congested, and undergoes yellow degeneration, abscesses form in the hemisphere, and effusion of lymph. The products of inflammation occupy also the arachnoid and the sub-arachnoid tissue. Protrusion may take place as an immediate consequence of fracture, but more frequently at a distance of days or weeks afterwards, when inflammation is more or less extensive, and would appear to have some predisposing influence; for it is often met with at an early period of life.

The symptoms are those of inflammation of the brain and its meninges, such as may exist without any protrusion.

The size and shape, according to the aperture in the dura mater, through which it had to pass, the tumour gradually increases in size, forming a large mass which may overlap and conceal the wound. As the tumour is gradually breaking down and sloughing, the tumour is constantly diminishing in size. Few symptoms, perhaps, of cerebral compression accompany this course of destruction; but at length coma supervenes, as the usual issue. Occasionally, the tumour, after having increased in size, sinks, it wastes away, and cicatrization of the wound takes place, the patient recovering without any apparent impairment of his health. The relative *mortality*, in fourteen cases, amounted to only two recoveries.

—As a general rule, *hernia cerebri* should not be interfered with, but treated as by means of a wet lint-compress and bandage, or the tumour, either by slicing it off, or by ligature, have both been proposed. But pressure is apt to induce coma, and excision is commonly followed by re-protrusion, with more profound coma. A third method has been proposed; the application of pressure *after* the protruded portion of brain, thus to avoid the perils of either

method separately, and that granulation with cicatrization may close the aperture. Generally, however, the better course is simply to keep the part scrupulously clean, by gently syringing with antiseptic solution, and dressing; assisted by slight pressure, when the protrusion is small. Any splinter or depressed fragment of bone, or other foreign body, should be extracted, when accessible without undue risk; and particular care must be taken, in such operation, not to injure the dura mater. Antiphlogistic measures must, of course, be combined with local assistance. The prevention of *hernia cerebri*, by compression, has proved far more successful than any curative treatment. Thus, the tendency to protrusion consequent on the removal of any loose portion of bone in comminuted fracture, after trephining, may be overcome by a well-adjusted pad of lint, and bands around the head.

Traumatic Inflammation of the Brain, and its Membranes

SYMPTOMS.—The symptoms of traumatic intra-cranial inflammation, principally these:—pain in the head, more or less intense, limited to the seat of injury, or spreading thence over the whole head; sleeplessness; contraction of the pupils; intolerance of light and sound, with general feverishness, as denoted by a rapid, bounding, hard pulse and hot, dry skin.

These symptoms, becoming more marked, are succeeded by great disturbance of the brain-functions; delirium or wandering, sickness, restlessness, tossing about, and perhaps convulsions. The aspect of the patient is indeed, sufficiently characteristic—the excitement and agitation, vernal eyes, injected conjunctivæ, flushed face, and throbbing carotids all indicate the state of the cerebral circulation.

The *second stage* contrasts very much with that of excitement. Drowsiness, stupor and coma, with dilatation of the pupils, a slow, labouring pulse, stertorous breathing, spasmodic twitchings of the muscles, hemiplegia, and relaxation of the sphincters, together indicate effusion, or compression of the brain. Rigors announce suppuration. But it is remarkable how tolerant the brain-substance is of abscess, owing to the collection of fluid consisting of disintegrated nerve-matter, with the addition of pus to produce the symptoms of compression.

The **CAUSES** of intra-cranial inflammation, consequent on injury of the head, are the various conditions of injury already described. Thus, concussion, wound, and contusion of the cranium; fractures of the skull, with injury of the membranes of the brain; concussion, contusion, compression, and wounds of the brain;—these several forms of lesion are the starting-point of inflammation. Erysipelas of the scalp or of the face may also give rise to meningitis.

TREATMENT.—The head should be shaved, and raised in an elevated position; and cold lotions or an *ice-bag* be applied. Free *purgation* must then be brought into action, and *blood-letting* in some form. Local bleeding by means of leeches applied to the temples, or cupping on the nape of the neck, will always be necessary; general blood-letting may be had recourse to according to the severity of the symptoms, and small repeated bleedings are safer and make a more permanent impression on the cerebral circulation than one large blood-letting. Antimonial salines prove useful adjuncts to these depletory and sedative measures, by continuing their influence on the system. Aconite (Fleming's tincture), in small doses, a drop or half a drop, in water, every three hours, is recommended by M.

as being safer than antimony, which is apt to induce vomiting. It had better not be administered in large or opiate doses; although, in the form of morphia, it may be given to control furious delirium. Potassium, in large doses, is said to be also very efficacious. Iodine, in small doses, combined with opium, should be pushed to salivation. These measures must be followed up by *derivation* from the head, means of blisters applied to the nape of the neck or the head. A leech-cap is used by the French Surgeons, and dressing the blistered scalp with mercury has sometimes been most effectual for restraining inflammation in the second stage of inflammation. Ultimately, *tonics*, especially iron with the mineral acids, and a generous *diet*, may be given with advantage to relieve the lingering headache, and restore the nerve- and muscular strength.

The state of the viscera, and of the *kidneys* in particular, should always be ascertained thoroughly, in relation to both the diagnosis and treatment of inflammation of the brain, arising apparently from any injury of the

Operative Interference.—When *acute* intra-cranial inflammation arises from compound fissure-fracture, early recourse to the operation of trepan is strongly urged by Mr. Hutchinson. The symptoms of fixed and violent headache, with feverishness, will indicate the occurrence of inflammation between the cranium and dura mater, before the supervention of cerebral inflammation—as arachnitis.

Depression of the brain, indicated by coma, and as depending on inflammation, may, however, more positively justify recourse to operation. It is the surest constitutional sign of suppuration, in connection with injury. Then with coma, and especially with hemiplegia, the only guide is the *situation* of the matter. Scalp-wound injury, or contusion of the bone, with perhaps a puffy tumour, will generally indicate the spot. The matter may be located between the bone and dura mater; or also beneath this membrane, although very rarely circumscribed, and beneath the arachnoid,—the dura mater then bulging up tensely into the foramen-aperture, and not presenting any pulsation. An incision must be made and the matter let out.

The operation will, therefore, be effectual in these two *exceptional* cases—(1) for the evacuation of matter *beneath* the *cranium* alone; and (2) associated with its *circumscribed* formation *beneath* the *dura mater*, in the cavity of the arachnoid.

The abscess in the *Brain* may be *superficial* or *deep*. The difficulty is to determine this question. Having trephined the skull, in consequence of compression-symptoms, one of two conditions may be found. The abscess may at once escape through an opening in the dura mater, that is, it may have sloughed over a communicating abscess. The difficulty is then to determine if the *membrane* is *entire*, *without bulging* under the foramen-aperture, and with symptoms still of compression, the question arises as to the situation of the matter, superficially or deeply in the brain.

In this doubtful condition, the dura mater has been divided; yet the patient has died with an abscess then discovered, situated just below the cortical substance of the brain, and thus provokingly close to the foramen-aperture; or again the abscess, so placed, has burst subsequently, and the patient entirely recovered. The fair inference is this—

The last two, impending death; the latter two, touching the seemed to afford the only chance of recovery.

Operation of Trephining.—The conditions of Head compression, which render this operation necessary or just, have already fully considered in connection with Fracture of the Skull; the latter is arising also from intra-cranial extension of intra-cranial expansion, consequent on Traumatic Expansion of the Brain, which remains to be described.

The distal ends resemble a trephine or trepan, so used according to the purpose of the operation—either the

portion of bone is compressed, or is of subjacent fluid blood, or pus. A Hey's saw are the special instrument

The head is around the seat of the bone, if not also by a scalp-wound, laid bare by a $\frac{1}{2}$ -inch shaped incision. with its centre-pin and fixed into the bone to be worked from with a firm, and not a light bearing (87). A fair groove thus made, the steel pin is no longer needed, and should be withdrawn.

The particular object of the operation can now be accomplished. *Pus* or *blood* will escape or may be evacuated; or a *depressed portion* of bone can be raised, by insinuating the elevator beneath it and bearing on the outer or the edge of the firm bone as a fulcrum. This implies that in trephining for fracture, the circular piece, or half-circle, of bone removed must communicate with the edge of the depressed portion and afford space for its elevation. Sometimes, a projecting portion of bone can be removed with a Hey's saw, or bone-pliers, and space thus made for the introduction of the elevator, without using the trephine. It should be seen that the elevator is passed beneath *both tables* of the bone; if accidentally introduced into the diploe, the outer table will be raised, but not the inner. And perchance, the inner table being depressed to a greater extent, the hole of the depressed portion is not raised, when the outer table lies quite level with the adjoining bone. Either of these contingencies—according to my own experience—may render the operation incomplete, and thus the symptoms of compression continue, or return if partially relieved for a time. It may be advisable, therefore,—and especially in punctured fracture,—to ascertain with a bent probe, whether there be any depression, or fragment of bone beneath the margin of the trephine-aperture—taking care not to detach the dura mater when not already separated by the fracture. The extraction of any fragment of the inner table must be done very gently; and in punctured fracture, a small fragment will easily slip into the brain more deeply, by a dipping movement of the forceps. In *unshot* fracture, no attempt should be made to discover a bullet, or other foreign body, by probing the brain. When a ball lies *upon* the dura mater, and *close* to the cranial aperture, this opening may be enlarged so as to allow of extraction.

Certain *parts* of the skull have been deemed ineligible for trephining; namely, over the occipital bone, in the course of the venous sinuses, and over the frontal sinuses. But I have not hesitated to trephine over the longitudinal sinus. In one case I removed a triangular piece of bone, two inches long, and one inch at the base; this fragment being tightly wedged under the parietal bone adjoining the sinus. Although the ultimate result was unsuccessful, the relief of depression-symptoms was so marked, that I had no reason to regret having trephined in a part of the skull forbidden by traditional rule. Over the frontal sinuses, the outer table may be first removed and then the inner. In a punctured fracture through the frontal sinus, I trephined to remove a depressed fragment, and the patient recovered.

In any situation, loose fragments or *débris* of bone must be carefully picked or brushed out, and the wound gently sponged clean; the scalp is then laid down, retained with a few sutures, if necessary, and antiseptic dressing applied. Sometimes, a pulsating hæmorrhage continues from beneath the trephine-aperture; then, I think it better not to close the wound, until the bleeding has ceased, lest, owing to the accumulation of blood, symptoms of compression should supervene.

The AFTER-TREATMENT consists entirely in measures preventive or curative of inflammation and its consequences.

Tumours of the Head.—(1.) The SCALP is liable to be the seat of Cysts and Wens, containing sebaceous matter; or Vascular tumours, as *Œvi*, and Blood-tumours.

colour and consistence. In a recent wen, the contained matter is whitish or yellowish colour, and is soft, like clotted cream; longer duration, this matter is greyish and firmer, resembling friable and sometimes stratified in concentric layers. Or they have a mixed character, partly soft and yellowish, partly greenish, brown, or black colour. These different appearances of sebaceous matter correspond to degenerative changes.

Wens are often multiple, giving to the head a singularly unsightly appearance; more conspicuous when the person is looking downwards.

The *Diagnosis* of an ordinary scalp-wen is simple; for a thin-walled cyst, the consistence may resemble a subcutaneous tumour, or lipoma, the irregular or somewhat lobulated surface and the doughy character of this form of tumour are distinctive. An abscess is distinguished by its more fluid or fluctuating, rather than firm character, the tumour is less movable—owing to surrounding inflammation—and when threatening to point, the throbbing, painful swelling declares its nature. A thick-walled sebaceous cyst is unlike any other kind of tumour. Sometimes, a black point may be found on the surface of the cyst, and through this—which is the obstructed duct of the cyst—some sebaceous matter may be squeezed, and thus the diagnosis is determined.

In the ordinary *course* of a scalp-wen, the tumour remains a harmless disfigurement. But it is ever liable to *inflammation* and the integument over the cyst acquiring a bluish-red colour, the surface becomes thinner and cracks, and an oozing discharge scabs the surface. When the scab is removed or falls off, a small fretting ulcer remains, which slowly, at length evacuates the contents of the cyst, leaving a cavity, with a thickened margin, and discharging a thin fetid secretion. The consequence of inflammatory infiltration around the cyst, the loss of its movable character, and, getting set in the scalp, resembles a carcinoma tumour with the integument over it inflamed. Scalp-wens.

alled cyst cannot be thus shelled out; but the membranous capsule may be detached with the handle of the scalpel, and torn out with the forceps. No portion of the scalp should ever be removed; when apparently redundant, it will contract; and even when unsound, it will recover itself. The lips of the incision may be brought together by narrow strips of common adhesive plaster, or closed by two or three points of suture. A wet-compress will promote the union of the surfaces of the cavity; and a whole dressing may be retained by a head-bandage. After entire removal of the cyst, the tumour never returns.

Another method of treatment consists in puncturing the cyst, or introducing a probe through the black-pointed obstructed duct of the follicle, in order to squeeze out the sebaceous matter; then, the opening being made of sufficient size, the interior of the cyst is freely cauterized with nitrate of silver, or a small seton passed in, thus to induce inflammatory adhesion of the cavity. But more often a prolonged suppurative discharge and open sore results; the cyst-cavity having become an indolent and unhealthy ulcer.

CONGENITAL sebaceous cysts are sometimes met with in the scalp, resembling ordinary wens in this situation, but distinguished by the tumour often lying in contact with the *dura mater*; the cranium being perforated, either in consequence of continued pressure or from congenitally incomplete development.

In infancy or childhood, the chief question of *diagnosis* is to distinguish between a wen of the scalp, and one which, through an opening in the skull, lies upon the *dura mater*; and which may also be an *encephalocele* or hernial protrusion of the brain. This distinction will be drawn, principally, by observing whether any such tumour enlarges and subsides somewhat under the movements of *respiration*, and is rendered fuller by the inspiratory acts of coughing or crying; and by the effect of *compression* producing any disturbance of the cerebral functions. Sometimes, the *origin* of the cranial aperture can be felt with the tip of the finger.

2. *Nævus* will resemble an *encephalocele*, or a sebaceous cyst with cranial perforation; the tumour being affected by the respiratory movements, and often seated in the *cranium*, as a pulsating tumour of bone, some cerebral disturbance may be elicited by compression. *Purplish discolouration* of the scalp-integument may also present a closer resemblance to *encephalocele* than to a perforating cyst-tumour. The more or less complete *disappearance* of the tumour under *pressure* is the chief mark of a vascular or svoid growth.

The question of *TREATMENT* turns upon that of diagnosis. It will be obviously perilous to remove a congenital subaceous cyst, which may be in close relation with the brain, unless the Surgeon be driven to thus interfere by the urgency of cerebral symptoms.

BLOOD-TUMOURS of the scalp, in the form of cephal hæmatoma—external to the skull, have already been noticed; but a blood-tumour sometimes arises from *communication* with a *venous sinus*,—the superior longitudinal, and usually in front, seldom in the parietal region, and rarely the occiput. This venous tumour may result from injury, or be produced spontaneously. Of *small size*—that of a chestnut, the swelling is identically *fluid*, and *elastic*—when *beneath* the *pericranium*, or coming *through* under the *scalp*, it presents a *bluish* appearance. The tumour is

increased by coughing, stooping, or by compression of the internal jugular veins; it sometimes faintly pulsates, but with no bruit; and subsiding under pressure, the perforation in the skull may be detected. Usually remaining stationary, or not enlarging much, although never disappearing, this tumour occasions *no brain-symptoms*.

No *Treatment*, therefore, is requisite, otherwise than a well-adapted support. These tumours have been specially studied by Dupont and Hermann Demme.

(2.) The CRANIUM may be the seat of various tumours, the principal forms of which are four in number: ivory exostosis, situated perhaps near the orbit, or on other parts of the cranium; fibrous or fibro-cystic tumour; myeloid tumour; and cancer.

(3.) THE BRAIN, AND ITS MEMBRANES.—(a.) *Fungous Tumours of the Dura Mater*.—Under this general heading, different kinds of tumour are comprised; some being innocent, and some malignant. They are *non-congenital*, and thus distinguished from naevi and from hernial tumours; and they *perforate the skull*, which distinguishes them from aneurism by anastomosis and from ordinary solid tumours. At an early period, a general diagnostic sign is the presence of a *thin crackling parchment-like layer of bone over the tumour*.

The *penetration* of any tumour through the skull is made known by *pulsation* communicated from the subjacent brain, and by the *cerebral symptoms* which pressure on the surface produces; sometimes, also, the *margin* of the opening in the skull can be felt. The tumour is seldom very prominent, often hardly raised above the surface of the skull, but feels like a soft pulsating spot in the bone. Such pulsating tumours may be single or multiple. According to the activity of their pulsation, *some diagnosis* may be made between these tumours. Active pulsation will probably denote soft cancer; pulsation communicated from the brain may indicate fibrous or fibro-cellular tumour. Some of these perforating tumours are not entirely of intra-cranial origin, but spring also from the *diploe* of the bone; and then the diagnostic character of pulsation becomes very equivocal.

No *Treatment* of any operative kind for the removal of these tumours will be warrantable or effectual.

(b.) *Congenital Hernial Tumours of the Brain and Membranes*.—Encephalocele and Meningocele are hernial tumours, respectively, of the brain and its membranes, or of the membranes alone, the protruding bag being filled with subarachnoid fluid; or brain-tumour is distended with ventricular fluid, constituting a Hydrencephalocele; and either kind of tumour results from congenital deficiency of the bone in some part of the skull, generally the occiput. The *tumour* thus formed varies in size from a pea to a protrusion exceeding the child's head; it is soft, rounded, and bluish in colour where covered by thin skin. Such a tumour resembles *naevus*, in its congenital formation, colour, and increasing size when the child cries; and it is also difficult to distinguish from a *congenital sebaceous cyst* in the scalp, with perforation of the cranium. The subject of this malformation is usually still-born or dies early; occasionally the child lives to an adult age.

Treatment by any operative interference will scarcely be justifiable. But—as with spina bifida—when the protrusion is rapidly increasing and

threatening to burst, a puncture, followed by evenly adjusted support, may be resorted to. In one case, an encephalocele was sliced off and the patient survived.

Hydrocephalus, and Paracentesis Capitis.—Sometimes the Surgeon is called upon to puncture the head, to relieve symptoms of compression in an otherwise fatal case of hydrocephalus, in childhood. This operative procedure consists in introducing a very fine trocar and cannula perpendicularly through the anterior fontanelle, away from the longitudinal sinus. Two or three ounces of the serous fluid having been allowed to escape, the puncture is closed with a piece of lint, and the temporary support of a bandage to the head will be advisable. The operation may have to be repeated occasionally, at perhaps intervals of two or three weeks.

Brain-Surgery.—**CEREBRAL LOCALIZATION.**—The localization of cerebral centres, from a surgical aspect, is thus defined by Lucas Championnière :

Lower extremity, summit of the ascending parietal convolution. *Upper and lower extremity*, summit of the ascending frontal and parietal convolutions. *Upper extremity*, middle portion of the ascending frontal convolution. *Upper extremity and aphasia*, inferior third of the ascending frontal, and foot of the third convolutions. *Facial paralysis*, inferior third of the ascending frontal, and foot of the second frontal convolutions. *Aphasia*, foot of the third frontal.

The general SYMPTOMS referable to cerebral tumours are *headache*—usually very severe, and limited to a single spot, or diffused over the whole head. Pain in the head is less frequently due to direct than to reflex excitation. It is persistent throughout the disease, and is increased by vibration of any kind; movement of the head, by light or by sound. Connected with headache, and often equally the effects of radiated influence, are tinnitus aurium, morbid acuteness of hearing, and painful sensitiveness to sound; disturbances of vision, diplopia, *muscæ volitantes*, and strabismus, which may be transient; formication, and sometimes hyperæsthesiæ of greater or less extent. Retinal changes comprise chiefly choked disk, optic neuritis, and atrophy of the optic nerve. Mental disturbances, and possibly delirium, also occur. The symptoms of compression may be expressed by “lowering of function,” comprising apathy, feebleness of memory, want of attention, confusion, and a general enfeeblement of ideas.

Vertigo may be noted, as a not uncommon primary symptom, with a staggering gait. Strange sensations in the head are also experienced; a feeling of liquid or of a mobile body; or that of a solid body filling the head, or pressing upon some portion of it.

Epileptiform convulsion, preceded by headache or vertigo, may also be a primary symptom.

Vomiting is evidential of irritation of the mesocephale, whether due to direct compression or to radiated irritation of the medulla oblongata. This symptom is unaccompanied with nausea or dyspepsia, and it will occur when the stomach is empty. It may be relieved by the recumbent position. Constipation also is often obstinate.

SYMPTOMS OF SPECIAL LOCALIZATION.—(1.) “*Middle Cerebral Lobes*; tumour of these lobes frequently gives rise to headache, as a prominent symptom, but otherwise the sensory disorder is mainly anæsthetic. Hemi-

plegia is common, and also convulsion of an epileptiform character. The convulsive attack is not rarely unilateral, and sometimes, at first, only one limb is affected. Thus, the locality of a tumour towards the anterior portion of the middle lobe may be determined by symptoms with tolerable accuracy. Various disturbances of sight and of hearing are met with; as well as various psychical abnormalities, ranging from mere confusion of ideas to absolute imbecility.

(2) "In the *Anterior Lobes*, tumour is attended with general headache, seldom of the frontal region in particular. No other sensory disturbance occurs. Sight and smell are frequently affected, speech seldom. Hemiplegia, convulsions, and psychical disturbance will occur much as in tumour of the middle lobes.

(3) "In the *Posterior Lobes*, the presence of a tumour is attended with general headache, seldom localized in the occipital region, and to other sensory disturbance. Hemiplegia, slightly marked, occurs; and convulsive attacks are very frequent. The organs of special sense evince no functional disturbances. The mental faculties are greatly changed, particularly in the tendency to depression.

"All three Lobes may be affected with tumour coincidently; and then the headache is very intense; the epileptiform convulsions exceed the paralytic phenomena; the organs of special sense are little affected; and there are various mental disturbances.

"In tumour of the convexity, the headache is generally limited either to the frontal region, to one side of the head, as a parietal affection, or to the occiput. There is, however, neither anæsthesia nor paralysis, but intense convulsions occur. The special senses are not disturbed. The mental condition is one of irritation, manifested by delirium and excitement.

"Lastly, very various regions of the brain may be the seat of tumour, concurrently, and then the morbid phenomena will be necessarily complex." (E. Long Fox, M.D.)

OPERATIVE TREATMENT.—With a view of reaching the seat of cerebral injury, or the locality of a tumour—when determined by the study of cerebral localization—the operation of *trepining* has been applied, during the last few years, as guided by the topography of the brain-convolutions in relation to the cranium. See the Author's larger work on "Surgery."

CHAPTER XXXVII.

INJURIES AND DISEASES OF THE NOSE.

Injuries.—(1.) **Foreign Bodies** are sometimes thrust into the nostrils of children in play. Pearl buttons, pebbles, peas, or other small bodies, may thus be lodged a little way within the nares, and easily seen or discovered by slightly dilating the nostril with a nasal speculum. Extraction can generally be accomplished by an ear-scoop, or a bent probe, or with *polypus-forceps*. Failing to remove the body through the nostril, it must be

into the throat. Sometimes, syringing with warm water will better in washing an impacted substance out, forwards or

epistaxis, or bleeding from the nose, may, in common with hemorrhages, be the effect of injury, or induced by some state of action or of the blood itself; determination of blood to the head in a subject producing *active* hæmorrhage of arterial blood; disease of the heart or liver opposing the return of venous blood, or the altered state of the blood in scurvy, purpura, and other diseases, producing *passive* hæmorrhage.

Violent exercises are liable to cause an attack,—as straining efforts in lifting, rowing, or running; the act of vomiting or defæcation; sneezing or coughing. The influence of predisposing causes is seen in the tendency to epistaxis among those who lead a sedentary life, indulge in the luxuries of the table, or bend the head and overstrain the brain in some intellectual occupation. Cold bathing, sudden changes of temperature or climate, altitude of locality, with therefore a change of atmosphere, are the chief external conditions which induce bleeding from the nose. Sometimes, such a discharge is simply vicarious of menstruation, or of an hæmorrhoidal flux, or of defective perspiration in diseases of the skin; or it may occur as a critical hæmorrhage in the course of various fevers.

In young persons, epistaxis is rarely a formidable hæmorrhage; in debilitated or enfeebled persons, it is often perilous.

TREATMENT.—Slight epistaxis, in young and healthy subjects, may be stopped when necessary, by sluicing the nose and forehead with cold water, or ice applied to the nape of the neck; and any tendency to its return may be prevented by purgatives and emmenagogues. Syringing the nasal fossæ with cold water or an alum solution, or the use of the syphon-douche, may be resorted to, otherwise, he had recourse to. In *plethoric* persons, to whom the nose often acts as a safety-valve, the bleeding should not be indiscriminately checked. Cold, rest, and dry-cupping from the back of the neck, or, however, become requisite, these measures being reinforced by styptics. *Passive* hæmorrhage is best controlled by styptics applied internally and applied within the nostrils. Gallic acid, in five-grain doses, is perhaps the most efficient; and the anterior nares may be plugged with a compress of lint or sponge soaked in a solution of chloride of iron, or tannin. Any concurrent disease, as the cause of the hæmorrhage, must of course be treated. A scorbutic condition often requires the administration of oil of turpentine.

In *persistent* epistaxis, or as arising from *injury*, can sometimes be stopped by elevating the arm to a vertical position on the side corresponding to the hæmorrhage; or both arms when the bleeding is from both. But it may become necessary to plug the nares, posterior and anterior, and care being taken to ascertain that the hæmorrhage proceeds from the anterior fossæ, and not, as occasionally, from the pharynx behind the soft

PLUGGING THE NARES.—This is most readily accomplished by passing a catheter, armed with a long piece of strong whipcord fastened to the handle, along the floor of the nasal fossa, through the posterior nares into the pharynx; then, seizing the cord with forceps as it appears behind

the soft palate, it is drawn forwards through the mouth, while the catheter is withdrawn from the nostril. The cord, thus passing round the back of the soft palate, hangs out of the mouth and nose. An oblong plug of lint or compressed sponge, of sufficient size to occupy the posterior nares, is then firmly tied transversely in a loop of the cord as it hangs from the mouth; and by pulling the cord through the nose, the plug is drawn back behind the soft palate into the posterior nares, guided and adjusted by the

FIG. 88.



forefinger of the other hand (Fig. 88). The anterior nares is then plugged with a compress of lint or sponge. When, on removing this compress, the bleeding has ceased, the posterior plug can be easily withdrawn by the end of cord which hangs from the mouth. Or the plug may be renewed—a fresh, clean pledget—by means of the cord. Belloco's sound is generally used for introducing the cord, but this instrument may not

be at hand; an elastic catheter is surely ready. The plugs should be withdrawn in two or three days, and the nasal fossæ cleansed by injecting cold water, or a weak solution of alum, as an astringent. Septicæmia has followed the retention of decomposing clots.

Diseases.—(1.) **Hypertrophy or Lipoma.**—An overgrowth of the cellular texture and skin of the nose sometimes occurs, arising apparently from enlargement of the sebaceous follicles, each to the size perhaps of a pea; and which is accompanied with some dilatation of the arterial capillaries, but more so of the veins, and with serous infiltration or fibrinous deposit; thus presenting a large, reddish-blue, and somewhat soft, lobulated, and pedunculated mass at the end of the nose. This inconvenient and unsightly mass is of slow growth and not dangerous; but the monstrous deformity will compel the unhappy individual to seek relief. It occurs seldom before fifty years of age, and in a somewhat broken constitutional state of health.

Removal with the knife is the only remedy, and a tolerably easy one. The tumour does not return.

(2.) **Cancer**, occasionally, affects the nose, in the form of scirrhous or encephaloid; but more often as epithelial cancer. These forms of growth present the same appearances as elsewhere. Treatment must be conducted in accordance with general principles.

(3.) **Lupus Exedens** seems to have a special affinity for the nose; it is an insidious and obstinate tubercular ulceration of the skin, and which produces frightful havoc, by the destruction of one or both alæ, the columna, or the whole of the organ; at length even involving the whole face in one common ruin. If the disease be arrested and cicatrization

remnant nose appears truncated obliquely from above the orbit, exhibiting two dark cavernous apertures with a thin-skinned, shining cicatrix—a hideous spectacle.

TR.—*Constitutional* measures are more remedial than topical in the treatment of any form of Lupus. The general health improved; assimilation and nutrition, more especially, should be promoted by means of iron, quinine, iodine, and cod-liver oil—the former agents being administered in such preparations as may seem to produce the most beneficial effect. Turning our attention to *local* applications, in the early stages of lupus, as a tubercular affection or an erythema, the disease may perhaps yield under stimulation, conjoined with constitutional treatment. Different Surgeons prefer various remedies; solution of nitrate of silver, ten grains to the ounce; or of silver in acetic acid; the benzoated oxide of zinc ointment; or

Ulcerative lupus should be subjected to cauterization, freely applied to the ulcer. Here, again, various caustics may be employed, such as nitric acid, the acid nitrate of mercury, potassa fusa, or zinc. I employ the latter, mixed with an equal part of flour, or starch. Or the Vienna paste is a good preparation; consisting of equal parts of quicklime and potassa cum calce, mixed up with spirits of wine. In using these powerful caustics, and particularly to such a part as the nose or cheek, the surrounding skin must be protected by a piece of lint, with a hole for the ulcer; and while the zinc paste may be employed, its work in the course of six or eight hours, the Vienna paste should be removed after ten or fifteen minutes, as it induces constitutional irritation. On removing the caustic, a poultice is applied to the non-exedens and the erythematous forms of lupus, cauterization being equally necessary; but the destruction of tissue need not be complete. Hence, strong solutions of caustic potash will generally answer the purpose.

Ulcer, as affecting the nose, is allied to Lupus exedens, or Epithelial Cancer; and similar treatment may be adopted. It is specially described in connection with the general constitutional treatment of Ulcers.

Fossæ.—(1.) *Ozæna* or *Rhinorrhœa*.—A muco-purulent discharge, having a fetid odour, yellowish or greenish colour, issuing from one or both nostrils. Proceeding from the mucous membrane of the nasal fossæ—here named pituitary or Schneiderian membrane—this discharge is symptomatic of various ulcerations of that membrane involving perhaps the bones forming the fossæ. Thus may arise Catarrhal Ozæna, which sometimes accompanies chronic Catarrhus of the nasal fossæ; and Syphilitic Ozæna. The diagnosis must be determined by the concomitant and antecedent constitutional symptoms. Impaction of a *foreign body* in the nasal fossa will at length produce an ulcerative discharge. *Injury* to the nose is occasionally the cause of Ozæna. The nose often has a broad and flattened appearance, as is the case of French authors.

Ozæna commences in infancy or in adolescence, and in either case lasts through life. It has been known to subside when menstruation is established, or after childbirth. But it is rarely cured, except by cauterization, and that in young subjects.

which had persisted for a period of years, and was attended with erosion of the mucous membrane. Mr. Ure prescribed with a liniment of fifteen grains of chloride of zinc and one ounce which was pencilled over the affected part, once a day.

(2) **Thickening of the Schneiderian Membrane.**—of the nasal mucous membrane not uncommonly occurs throughout the whole extent of the fossa, and in both nostrils; frequently the hypertrophy is limited to the portion of mucous membrane the inferior spongy bone.

Symptoms.—The affection causes uneasy breathing, especially in cold and damp weather; there is also perceptible swelling in resembling polypus; but it is of a deeper red colour—never not pedunculated. It may also, unlike polypus, be situated on both sides. These appearances were well marked in a case which came under my notice many years ago; and in that instance the lower lip was bent to the side opposite to the thickening, thereby characters more clearly.

Thickening of the membrane, as thus described, may be temporary, or follow chronic coryza. This latter is an affection of the Schneiderian membrane, in a chronic state, attended by a thin, acrid, ichorous discharge from the nostrils, catarrhal, or have a syphilitic or scrofulous constitutional origin.

Treatment.—The topical applications of astringents, by means of injections already noticed with reference to ozæna, will probably diminish the chronic thickening of the membrane and restrain any coryza. But these measures must be supported by appropriate constitutional treatment, as also requisite in the various forms of ozæna.

(3) **Polypus.**—Tumours of very different kinds growing from the nostrils, are associated under the common term "nasal polypus," which agree only in being pedunculated, and as obstructing, more or less completely, the nasal passages. Their structural differences and characters are as follow:—

1. **GELATINOUS OR MUCCOUS POLYPUS**—the ordinary form. This is a soft, pulpy, slightly elastic tumour, of a greyish-brown

ypus usually forms at the same time; and, several co-existing, distinct peduncular attachment. But the lowest or most presents downwards in the open nostril, while the others and compressed; one overlying another or others, like toad-air growth. Polypi may nares simultaneously. occur at any age, but

FIG. 89.



ptoms are—a sense of nostril, as if proceeding cold in the head, and with the state of the polypus diminishing in atmosphere, enlarging protruding in moist weather mucous discharge from fits of sneezing, commulsion. Respiration nares becomes embarrassed more, the patient with his mouth open, thus with his head, snoring loudly. The

as a nasal twang, is indistinct and snuffling; and the special ected with surrounding organs, become affected by the polypoid cell and taste are impaired or lost. Deafness ensues, due tent thickening of the membrana tympani. In addition to certain phenomena may be elicited. On stopping the free ree nostril, by pressing that side of the nose with the finger, cannot breathe through the affected nostril, or imperfectly, g expressed by a forcible effort, with a whizzing or singing patient then feels something shifting its place to and asal cavity, and the Surgeon hears a peculiar noise, like the flag. On directing the patient's head backwards, the polypus or brought into view by dilating the nostril a little with a speculum; and the tumour is observed to have the character- unces already mentioned. Ultimately, the nose acquires a ad, laterally dilated, or frog-faced aspect; giving a singularly l expression to the upper part of the face.

s.—Gelatinous polypus must be distinguished from common yza, from thickening of the mucous membrane covering the gy bone, from displacement of the septum to one side, from e septum, and from an extraneous body, as a fruit-stone or a s. Certain other polypoid growths are also liable to form in esa, but these may be diagnosed chiefly by their special

rs POLYPUS presents a firm resistant tumour, instead of a substance like an oyster; and which does not vary in size with changes. It is more broadly pedunculated, and springs from m beneath the mucous membrane. Its structure is essentially being much more vascular than gelatinous polypus, has a

greater tendency to bleed. Sometimes it becomes encrusted with phosphate of lime, and partially ossified. It may spring from the *septum*, and is usually *solitary*.

This species of polypus grows more *rapidly*, and attains a *larger size*; the tumour causes greater displacement of the surrounding bones in the nasal fossa—as deviation of the septum, depression of the palate, projection of the nasal bones; or it extends backwards and is prolonged into the pharynx. It is also apt to send offsets into the various sinuses, in the frontal, ethmoid, and superior maxillary bones, thus appearing in situations where little expected, as in the pterygo-maxillary fossa, or in the orbit through an aperture formed in its inner wall.

All the *symptoms* due to the presence of a tumour in the nasal fossa are much more aggravated. The Surgeon should, however, remember the possibility of a polypoid growth springing from within the *cranium*, the frontal sinus, or the maxillary antrum, and making its appearance in the nasal fossa.

3. MALIGNANT OR CANCEROUS POLYPUS.—This, the third species of polypoid growth, is a *soft* tumour, of a *deep red* or *dark purple* colour, prone to *bleed*, and *painful*; *fixed* to the bone, and springing, perhaps, from a *greater depth*, within the cranial or sphenoidal cells. The nasal portion may be only the external protrusion of a deep-seated medullary tumour. Growing *rapidly*, with great expansion of the nostril, it tends to protrude through the nasal or lachrymal bones, and frequently displaces the eye. It discharges a fetid, bloody, ichorous fluid; while repeated hæmorrhage, and acute, lancinating pains, striking up into the root of the nose and forehead, accompany the development of this species of polypus, and reduce the patient's strength to the last extremity. The disease occurs only in adults or in advanced life.

TREATMENT.—The three species of polypus, above described and contrasted, are incurable by any known medicinal treatment, whether local or constitutional. Removal by operation is the only resource, but the different species of tumour are thus removable with very different degrees of facility, and probability of non-recurrence.

1. GELATINOUS polypus may perhaps be withered by the influence of astringents; especially powdered tannin, which may be blown into the nostril through a quill, or other small tube. Very rarely, the polypus separates, and is expelled *spontaneously*; and its ejection has been known to happen, after the repeated application of strong stimulant injections, by sloughing of the tumour. But this would be an uncertain and incomplete result, and probably followed by recurrence of the growth.

This species of polypus is usually extracted with *forceps*, by a combined movement of pulling and twisting. Forceps having rather long, serrated blades, to hold securely—nasal polypus-forceps—are used for the extraction, the instrument being made of sufficient length, slender, and straight, or slightly curved, according to the situation of the polypus. The neck of the polypus is first clearly ascertained by running a probe round the tumour, above and below the middle spongy bone, or its peduncular attachment elsewhere. Then—the patient sitting facing the light—the Surgeon, standing in front, elevates the tip of the nose with his thumb to gain as good a view as possible of the polypus; he introduces the forceps closed into the nostril, and approaching the pedicle, opens the blades just

sufficiently to slide one above and the other below, and securely grasps the pedicle. A little movement of the hand will convey the feeling of attachment, while the soft, yielding texture of the polypoid pedicle, in closing the blades of the forceps, further gives assurance that the spongy bone, a crackling texture, has not been seized. By a gentle pull and jerking twist with the instrument, the polypus is detached and withdrawn from the nostril. Several polypi may successively be removed in like manner, care having been taken to distinctly feel the peduncular attachment before attempting to extract the growth.

This method of extraction is attended with considerable pain, and not inconsiderable hæmorrhage; it is a piecemeal procedure, and is apt to break and detach a small scale from the spongy bone, with the pedicle of the polypus, resulting in caries.

I, therefore, some years since, devised a forceps which cuts and holds the pedicle. The "*polypus scissor-forceps*," as this instrument is named, combines scissors and rasped forceps, one edge of either blade being that of an ordinary scissors, the other broad and rasped.

A general clearance of the nares has been effected by *drawing a plug* from behind forwards—a brushing mode of extraction, suggested, I believe, by Dr. M'Ruer, an American physician, who highly extols it. A piece of catgut is introduced, through the nostril into the mouth, to which is fastened a piece of soft and dry sponge, corresponding in size, when firmly compressed, to the narrowest part of the nasal passage; it is then drawn gently forwards through the nose. In at least ten cases, all the adventitious growths were thus brought away.

Ligature is chiefly appropriate when polypus passes through the posterior nares, and hangs down in the pharynx—*naso-pharyngeal* polypus. The object of the operation by *ligature* is to accomplish strangulation, and separation of the polypus in the form of a slough. Accordingly, a loop of firm whipcord, catgut, or silver wire, is passed through the nostril into the pharynx, and expanded under the polypus, and drawn up around the peduncle, this noosing procedure being aided by introducing the forefinger into the mouth. The ends of the cord, at the nostril, are passed through a slender, double cannula, which is then slid along upon them through the nares to the polypus, when, by tightening and securing the ends of cord to the rings at the nasal extremity of the cannula, the peduncle of the polypus is strangled. The cannula may be introduced threaded with the whipcord, if this seem to be a more easy way of passing the loop. The cord must be tightened, through the cannula, from day to day, until separation of the tumour is effected; or it may be removed at once, rather than allow it to slough away. Hilton's *snare* instrument may be used for immediate strangulation and removal of a polypus, whether within the nasal fossa, or pendent in the pharynx. In either modification of this operation, care must be taken, lest the tumour drop into the lower part of the pharynx or over the larynx, and cause suffocation; and during the process of sloughing-separation, the head should be inclined forwards to avoid the risk of fatal systemic infection from the morbid secretion, a result which has actually occurred.

Occasionally, it may be necessary to *slit up* the *ala* of the nostril, at its junction with the cheek, in order to gain access to the root of the tumour.

An up-turning of the nose may suffice to reach the base of the growth; simply by incision around both alæ; or coupled with division of the nasal process, and fore part of the septum.

A *button-hole-like* incision in the *soft palate* has been resorted to by Maisonneuve, so as to draw the polypus through the opening into the mouth, where it can be ligatured or cut off with the knife. The direction of the button-hole is from before backwards, and the great elasticity of the soft palate readily allows the polypus to pass through a comparatively small opening, which also generally closes without the aid of suture. The procedure—the *button-wire* *palatine*—has yielded the most satisfactory results in the hands of M. Maisonneuve.

2. **FUNGUS polypus** may, perhaps, be extracted with *forceps*, or tied when pedunculate. *Excision* has succeeded in broader-based and large-sized polypi of this kind.

Excision of the *upper jaw* should be resorted to, only when, after rhinoscopic examination, it appears impossible otherwise to reach the whole base of a polypoid naso-pharyngeal growth.

In performing either of these operations, the Surgeon will, of course, not limit himself to the removal of a highly vascular polypus by the knife; the *scraper*, or the *galvanic-wire cauter*, may be used, to avoid the risk of hemorrhage.

3. **CANCEROUS polypus** is perfectly irremediable and uncontrollable by any surgical proceeding.

Tumours of the Septum.—Besides abscess of the septum, presenting its characteristic swelling, certain tumours, containing blood or of a cartilaginous consistence, are liable to form in the septum nasi. The *bloody tumour* is always the result of injury, and has the appearance of ecchymosis in other parts of the body. Absorption of the extravasated blood should be promoted; incision is rarely necessary. *Cartilaginous tumour* is very uncommon. Mr. Ure met with one such case, and wherein he effected a cure by excision; the junction of the ala of the nose with the cheek having been slit up, in order to make room for the application of a gouge to remove the tumour. A *gelatinous tumour*, of uncertain nature, sometimes forms in the septum. It may be obliterated by snipping away a portion of the wall, and canterizing the interior with nitrate of silver.

Calculi or Rhinoliths.—Calcareous concretions occasionally form in the nasal cavities; usually in the lower meatus, or they may originate in the frontal sinus or in the maxillary sinus, and thence pass into the nostril. They vary in size from a date to a hazel-nut, or may completely block up the nares, and produce deviation or partial destruction of the septum. They present an uneven surface, and are of a black, grey, or white aspect. Sometimes single, in other cases multiple, nasal calculi consist of phosphate and carbonate of lime, magnesia, and mucus; resembling other concretions. The nucleus may be an extraneous body, a cherry-stone, or portion of a tooth. The cause of these concretions is obscure, probably chronic inflammation of the Schneiderian mucous membrane.

TREATMENT will, obviously, be the extraction of such bodies by suitable forceps or scoop; and then to allay irritation.

Plastic Surgery of the Nose—Rhinoplastic Operations.—The entire nose, or a portion only, may require to be remade; in can-

destruction by disease or injury, or owing to congenital mal-

—Restoration of the entire nose may be accomplished by plastic operations. In both the nose is remade by borrowing a revised flap of sound integument, and adapting it to the nose,—itself in a sound state for its reception; but in one operation—Tagliacozzi, or the Italian method—the flap was taken from the arm; in the second, or Indian operation, the flap is taken from the forehead at the root of the nose. The latter operation is now generally.

Operation.—This operation consists of three distinct periods in succession, at different periods, to complete the result. (1) the elevation of the flap from the forehead, and its attachment to the nose; (2) the detachment of the root of the flap where it is from the forehead, and the formation of a proper bridge to the formation of a columna nasi. The flap of integument is a triangular piece of leather is cut into the shape requisite for the base and apex of the nose, resembling the shape of the former nose in a congenital case, of such fashion as may suit the face. An allowance should be made, as the new nose shrinks considerably for its formation. Each alar portion should be sufficiently free

being turned in to form a nostril. This outline model is made on the forehead with its base up to the eyebrows at the root of the nose. The outline is marked out on the forehead with ink (Fig. 90). If the forehead flap may be somewhat on either side, rather than enclose the scalp, and perhaps form a bridge to the nose. The cicatrized remnant of the old nose is then to be freely but not removed. The flap, as marked out on the forehead, must be dissected down; and taken to make it of uniform width, not to interfere with the hair on the pericranium; and that the flap, at the root of the nose, is of sufficient length to allow of its being turned in without affecting the circulation,

FIG. 90.



as the channel through which the supply of blood to the flap is to pass. To facilitate this twist, the incision may be extended a little downwards on the side to which the flap is turned. Bleeding stopped, the flap is brought round and its edges neatly adjusted to the margin of the remnant nose, and evenly fixed with sutures; the edges of the flap inwards, which will thus give the resulting organ. The new nose is to be supported, not with a little oiled lint; and wrapped in cotton-wool to maintain the shape. The edges of the wound in the forehead, corresponding to the incision, are to be united with a suture; the rest of the surface healing by granulation, a water-dressing should be applied.

In a few days the nose will have become plump and purplish red; but, this subsiding, union takes place and the organ becomes consolidated.

Then, after about three months, the *twisted strip* of skin may be cut through, and adjusted evenly. To avoid a pucker, it may be necessary to excise a small portion.

The *columna nasi* is best restored by forming it out of the upper lip. First, the inner surface of the apex is pared. Then, a perpendicular strip is cut out of the centre of the upper lip, a quarter of an inch in breadth, and consisting of the whole thickness of the lip. The *frænum* having been divided by a touch with the bistoury, this strip of lip is turned, not twisted up; the labial margin is thinly pared, and the raw surface adapted to that of the apex; the two are retained with a twisted suture, and the edges of the lip-wound brought together by two or more sutures. If troublesome bleeding occur from the coronary artery, one of these sutures should be so placed that the needle shall transfix the ends of the vessel.

During the process of complete restoration, the nostrils must be dilated occasionally, by introducing silver tubes up these passages. The exposed mucous membrane of the raised strip of lip acquires a cutaneous character, while the interior of the nose resembles a mucous membrane and is moistened with a mucous secretion.

Certain *exceptional* conditions may be met by different plastic operations, which are fully described in the Author's "Surgery."

(2.) *ALA*.—When *one ala* only is deficient, a flap of integument, suitably shaped, may be raised from the *cheek*, and adjusted to the part, the edges of which have been previously pared, and retained there by a few points of suture. When *both alæ* are wanting, or if the *cheek* be thin, the flap had better be brought from the forehead. The connecting pedicle will necessarily be long and thin; and to maintain the vitality of the engrafted flap, a groove had better be made in the dorsum of the nose to receive the pedicle. Nasal fistule may admit of repair in like manner; the aperture being closed by a portion of adjoining skin borrowed from the cheek or forehead.

DEPRESSION NOSE.—Depression of the *apex*, or of the *bridge* of the nose, may severally occur; owing to the loss of the septal cartilage, or of the septum and nasal bones,—the fabric of the organ, although the external parts remain entire.

These defects may be remedied by loosening the alar connections of the nose, and drawing integument from the cheeks; thus raising the depressed portions of the organ.

The *Frontal Sinuses* are subject to certain diseases not peculiar to those osseous cavities, but originating in them as the seat of disease: abscess, cysts, exostosis, and polypus. TREATMENT will be the same as for these diseases elsewhere.

CHAPTER XXXVIII.

RIES AND DISEASES OF THE MOUTH.

Wounds of the lip differ in no way from these lesions in that the liability of excessive hæmorrhage, compared with the injury, when the coronary artery is divided. The vessel is secured by means of a twisted suture, as for hare-lip; and taken that the pin which brings the surfaces together, shall be on either side, so as to command the cut ends of the artery mucous membrane. It should be observed that the cut is placed in even apposition, as shown by the *margin of the lip*. Three days the pin may be withdrawn, leaving the twisted tied with blood, as a support, until it drops off.

—This deformity is a *congenital fissure* of the upper lip, of development. It is usually situated a little to the left side of the line of the lip below the nostril; sometimes on the right or case forming **SINGLE** hare-lip. Two such fissures may be on either side, the central and intervening portion of the lip is a short rounded process; forming **DOUBLE** hare-lip. One is usually deeper than the other, passing even into the nostril. In this latter deformity of the lip, the median portions of the maxillary bones,—each containing the two incisor teeth, and constituting a distinct bone in the human embryo and in the lower jaw the *inter-maxillary* or pre-maxillary bone,—may be disconnected on both sides and project forwards, or depend from the nose, as a snout. Fissure of the bony or *hard palate* or of the cleft palate—not unfrequently co-exists with hare-lip; or in the alveolar arch may extend backwards into a fissure of the palate.

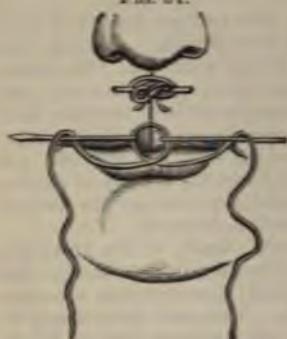
Cleft palate, however, frequently exists without hare-lip. The functional inconvenience attends this deformity, but hare-lip interferes with the infant's power of sucking.

ST.—The *age* for operation—to remedy this congenital defect, depends to the strength of the child, will be about a month or six weeks. There have been successful results at all ages.

—The child having been swathed in a large towel or piece of muslin completely securing the hands and feet, it is laid in the position so that the head of the infant shall be fixed between the knees. Chloroform may of course be administered, but even if not used the position of the child, as described, will much facilitate the operations. Taking the lower corner of one side of the fissure with the thumb and finger and pulling forward the lip on the stretch, the surgeon divides the *frænum* with a straight and narrow bistoury, and carries the lip; entering the point of the knife at the *apex* of the fissure, carrying it forwards to the margin of the lip, the edge of the knife is held on that side, and then on the other side, held in like manner being taken that the whole *thickness* of the lip is pared. The edges are brought together and evenly adjusted, and secured by

one or two twisted sutures (Fig. 91). The hare-lip pin should be entered from one-third to *half an inch* from the cut edges, and passed deeply, to about *two-thirds*, through the substance of the lip, on either side of the fissure. A strong silk thread is twisted round the projecting ends of the pin, over the lip, in the form of a figure of eight. The point of the pin

FIG. 91.



is snipped off with small cutting-pliers, the head of the pin remaining on the other side. A second suture is applied in like manner. It is most important to observe that the line of continuity of the *labial margin* be maintained, and that there be no angular puckering at the apex of the fissure. No dressing is required.

When inequality of the fissure exists, Mr. Lloyd was in the habit of preserving a small slip of the flap of the long half of the lip, and of attaching it to the under surface of the shorter half, that there might be no notch or fissure remaining after cicatrization.

The time for withdrawing the pins is, usually, about the fourth day; or the labial one may be left for a day or two longer. The pin must be gently withdrawn, and the twisted thread caked with the oozed blood should still be left undisturbed on the lip, to which it adheres as a plaster. If this precaution be taken for some days longer, there will scarcely be any necessity that the recently united wound should be supported by "adhesive strapping," or for the use of the spring "check-compressor" devised by Mr. Hainsby.

Simple sutures—without the steadying support of pins—are in favor with some Surgeons.

DOUBLE hare-lip, without malformation of the upper jaw, is treated on a similar principle. If the central lobe between the fissures be of full breadth and *length down* to the prolabium, the margins of both fissures should be pared independently, and united separately; but if the central portion be *short* and rounded, it should be sliced to a point downwards and the pared margins of the lip united, embracing this little V-shaped piece above and coming into contact with each other below. In both cases, the same needles are sufficient to retain the two fissures, by transfixing the central lobe; the threads are wound round as before. Both fissures may be pared and treated thus simultaneously; or at separate periods, in order, it is said, not unnecessarily to increase the chances of failure.

The median—*inter-maxillary*—portion of bone, containing the incisor teeth, which not unfrequently complicates double hare-lip, must be dealt with when it *projects* so as to prevent union of the wound. The projecting portion may be removed with small cutting-pliers; or it can generally be made to recede by gentle *pressure*, in the course of a few weeks,—this plan of treatment having the obvious advantage of preserving the incisor teeth. Pressure can be applied effectually by means of a spring-truss, worn

hours daily, until the portion of bone is sufficiently depressed to the lip to be brought over it into easy apposition, prior to operation. Mottoul seizes the projecting portion of bone with strong forceps, and breaks and forces it into the perpendicular; and this immediate replacement has proved successful. If the piece be connected to the septum nasi, it will probably be necessary to remove a triangular piece downwards, out of the latter—as Blandin suggested—before attempting to press back the projection. A co-existing cleft in the hard palate will probably become narrower when the inter-maxillary portion of the alveolar process is removed; and thus an artificial palate can be applied with greater ease, in after years.

Epithelial Cancer affects the lower lip, very rarely the upper lip, presenting as a small warty growth on the lip, or as a hard tubercle, or an excoriation of the mucous membrane, surrounded by an inflamed thickened base, the disease is primarily situated in, or just beneath, the mucous membrane, at or near the junction of the two in the red part of the lip. Spreading thence, the wart grows in breadth and thickens, the tubercle peels and ulcerates, or the excoriation deepens. Eventually the ordinary characters of epithelial cancer are presented. The submaxillary glands become involved, and thence enlarged and indurated. The progress of the disease, as in other parts, may here also be extensive; even destroying the lip, and the lower jawbone and teeth becoming loose. Pain and discharge sometimes wear down the patient.

DIAGNOSIS from chancre of the lip is mainly determined by the disease presenting a superficial ulcer, raised on a base of cartilaginous hardness, the sore may cicatrize, and the indurated base remain. The submaxillary glands enlarge at an early period, six or eight weeks after the disease commences. Secondary symptoms appear sooner or later, unless treatment has been adopted. The upper or lower lip may be equally the seat of chancre. Cancer of the lip occurs almost exclusively in old age, after the middle period of life.

A local and exciting cause of cancer would seem to be some source of irritation; commonly the adhesive contact of a clay-pipe when not removed with sealing-wax, or a sharp broken tooth.

TREATMENT.—*Excision*, free and early, is the only cure. Some affection of the submaxillary glands does not forbid this procedure; but they should be extirpated. The incisions in the lip must be directed according to the line of disease. A V-shaped incision will best include the diseased portion when it extends downwards in the lip; a quadrilateral incision in other cases; or a more superficial semicircular sweep, when the disease extends along the lip. The lines of incision should be brought together with twisted sutures, as in the operation for hare-lip; a horizontal incision may be closed by simple sutures, uniting the opposed edges of skin and mucous membrane.

The operation sometimes proves permanently successful; but often the disease returns in from six months to two years. Excision should, however, be repeated, to prolong life.

Very rarely, other forms of cancer affect the lip, and more often the cheek.

Cheeks.—**Salivary Fistula** is a perforation or division of the excretory duct of the parotid gland, whereby the saliva dribbles out on

the cheek. This condition may result from wound of the cheek, sometimes in removing a tumour situated over the duct; or in consequence of abscess or ulcer of the cheek, implicating the duct. The fistulous aperture and trickling saliva are a source of great disfigurement and inconvenience.

TREATMENT.—The object is to restore the continuity of the duct, as the natural channel for conveying the saliva into the mouth, where it opens upon the inner surface of the cheek, by a small orifice, admitting only a very fine probe, opposite the crown of the second molar tooth of the upper jaw.

Recent salivary fistula can sometimes be closed by pressure alone, by means of a compress applied over the fistulous aperture in the cheek; the saliva resuming its natural course through the duct, which still remains open. I have thus cured a fistula of this kind, in two instances. In a more established condition, the edges of the external aperture should be pared and brought together, and then pressure applied. *Confirmed* salivary fistula is probably attended with closure of the natural opening into the mouth. It will be necessary to form an artificial communication with the duct; and this may be done, either by passing a small seton from the inside of the cheek into the fistula; or by introducing a wire, red-hot, or heated by galvanism. The external fistulous opening must then be pared and closed with a twisted suture.

Tongue.—Diseases.—Glossitis.—Acute inflammation of the tongue is attended with sudden enlargement of the organ, which protrudes from the mouth, presenting a red mammillated appearance, with profuse salivation; while the patient can neither speak nor swallow, or scarcely breathe. It is met with rarely as an idiopathic affection, but sometimes as a consequence of over-salivation from the abuse of mercury, or of scalding or corrosive fluids.

TREATMENT is urgent, and the tension resulting from infiltration of serum and from congestion can be at once relieved by a free incision on either side of the raphe, along the dorsal aspect of the tongue, thereby avoiding the ranine arteries. But it should be remembered that the oedema may so far involve only one side of the tongue as to cause the lower surface, which swells more readily, to be turned directly upwards; the incision made above thus passing into the tissues naturally inferior, and which would resume this position as the swelling subsides. *Tracheotomy* may have to be resorted to for the relief of dyspnoea. Saline purgatives will, however, usually complete the reduction of the swelling, when they can be swallowed, after the immediate relief afforded by incisions. Astringent and cleansing gargles are also useful adjuncts.

Tuberculous or Strumous Ulcer.—Originally described by Sir James Paget, this form of ulcer presents certain tolerably definite characters. Following an accurate description given by Mr. Butlin:—The surface is uneven, pale, and rather flabby, granulated, often covered with yellowish-grey viscid or coagulated mucus; the edges are sometimes sharp cut, sometimes bevelled, seldom elevated, or everted, or undermined, not usually very red, but often redder than the surrounding tongue; there is very little surrounding *induration*—indeed, there may be none; the adjacent portions of the tongue are generally a little swollen, sometimes much so and sodden; the outline of the ulcer has no characteristic shape, but the borders are often sinuous, and the shape is not unusually oval, or ovoid, or elongated.

depth of the ulcer varies much; in the earlier stages it is superficial, as the disease advances it may eat deeply into the substance of the tongue, and more or less deeply at different parts. It is almost invariably fatal in the advanced stage, and nearly always accompanied with pain.

The ulcer commences in various ways: by the breaking down of a small papule or vesicle, or by the formation of a tiny nodule, or a little yellow spot or patch, which gives way before it attains half the size of a pea. As the sore increases, *sloughing* may supervene, destroying the granular appearance of the ulcer; or a gradual deliquescence of the tissues taking place, the muscular texture appears like the fibres of raw meat. The *lymphatic glands* beneath the jaw commonly become enlarged; and generally death ensues within a few months, or at the most a year or two. Granulation sometimes results in healing of the sore; but usually ulceration recurs, and terminates fatally.

Men are more often attacked than women—in this respect resembling venereal and syphilitic ulcers. Occurring more frequently in adults than in children, no period of life is entirely exempt, from early childhood up to old age and seventy years of age.

The tuberculous ulcer may occur either as a *primary* or as a *secondary* manifestation of tubercle; the former being extremely rare.

In the DIAGNOSIS of tuberculous ulcer of the tongue, the disease may be mistaken for *syphilitic* or *cancerous* ulceration. The characters of the ulcer, although tolerably definite taken *collectively*, must be considered in connection with other evidence of *tuberculosis*, or at least a phthisical tendency. But while this constitutional condition is the essential cause of the lingual disease, local irritation, from a rough decayed tooth, not uncommonly gives rise to the ulceration. Constitutional predisposition is, however, evinced in the production sometimes of more than one ulcer of the tongue.

Mucous Tubercle, Gummy Tumour, Psoriasis, and Ichthyosis are diseases which mostly have a Syphilitic origin, and may be treated in like manner. A brief description of the *characters* of these diseases will enable the Surgeon to recognize, and distinguish

MUCOUS TUBERCLE of the tongue appears in the form of *circumscribed elevations*, situated usually on the sides or under surface of the tongue. Varying in size from that of a split pea to a sixpence, or larger, the elevation is *flat* and *broad*, and of a *whitish, opaque* colour; or it may be more prominent, even *papilliform*, and of a *reddish* hue. These differences of appearance depend on whether the epithelium be chiefly thickened, or the papillae enlarged. The *absence* of *circumferential induration*, with a *painless* and *indolent* character, will distinguish these mucous patches from *epithelial cancer* of the tongue. And, the co-existence of other symptoms of syphilis—secondary rather than tertiary—may aid the diagnosis. Ulceration is apt to take place, destroying the usual characters of the mucous patches; and then, more especially, sometimes the dorsum or base of the tongue is beset with a number of small, round eminences—mucous nodules, corresponding to the circumvallate papillae.

GUMMY TUMOUR presents *small, hard, painless lumps*, under the mucous membrane, or deeper in the substance of the tongue. Growing

and often undermined. Sometimes, the ulcer appears in the oval fissure, deep and ragged, running along the side of the across its diameter. Destruction progressing slowly, the margin may ultimately subside, and soften, while granulations filling the cicatrization leaves a pockered scar, with loss of tongue-substance; instead of ulceration, absorption may remove the soft matter, or it may partly undergo a calcareous transformation.

3. *Psoriasis* of the tongue—so named, consists of *thickening* in the form of a circumscribed irregular patch, having an *umbilic*; the papillary appearance being lost, and replaced by *ramifying* grooves. After a day or two, *desquamation* takes exposes the mucous membrane, the surface then appearing the papilla, and of a deep red colour. Other syphilitic affections of the tongue may co-exist; but this may also arise from the irritation of carious tooth, or of a pipe, and sometimes it proceeds from gas ment.

4. *Ichthyosis* is, properly speaking, a papilloma of the tongue, the appearance of a warty growth,—the papilla being much covered with a leathery, opaque layer of thickened epithelium, varies in thickness and its adhesion, at different times,—so that sometimes looks cleaner or more loaded; and the coating may readily removed, or harder and adherent. The whole tongue, then presents a *lobular surface*, intersected by *ramifying* grooves, *milky-white*, granular appearance, and *contracted* shape. It allied to epithelioma; it is commonly a syphilitic affection, but may arise from dyspepsia. A lingual condition, bearing some resemblance to *ichthyosis*, is described by Mr. T. Smith, as the *earthy* tongue calcareous matter, white, dry, and rough, having formed on the tongue. They were closely adherent, and had existed for without giving any pain or inconvenience. This state would result from salivary concretion.

tongue, and situate often opposite the last molar or wisdom
 leterable pain and difficulty are experienced in moving the
 leglutition, and pain darts along the Eustachian tube towards
 saliva flowing from the mouth, and fetid secretion accumu-
 broat and exciting cough, combine with the pain, sleepless-
 of nourishment, to reduce the patient. At length a *deep*
 r is produced, and hæmorrhages occasionally supervene. The
 glands become involved; presenting first a circumscribed and
 tumour in the neck, covered by reddened and thinned in-
 s also ulcerates and discharges a thin fetid fluid, with occa-
 rhage. Emaciation and cachexia ensue, according to the
 disease.

CANCER, in the shape of an *irregular lobulated* mass, of *reddish-*
 with vascular red points, and of a spongy succulent character,
 of malignant disease in a case recorded by Mr. Ceely, of
 The tumour protruded from the mouth, and a large portion,
 teen drachms and a half, was easily peeled off, exposing a
 surface covered with coagula. But the hæmorrhage was
 soon repressed with matico powder. The growth returned
 k, yet the man was still alive thirteen years after the

LIAL CANCER appears almost as often on the tongue as on

It presents an *opaque white raised patch*, consisting of
 lial scales, which becoming detached at length exhibits an
 ilar surface, with *hard everted* edges produced by epithelial
 and the ulcer. Considerable pain may be experienced. The
 glands sometimes remain unaffected. The disease progresses
 case existing twelve years, in another sixteen years; a far
 of duration than in other forms of cancer-growth.

the tongue is a primary disease, with rare exceptions. Some
 seems to be conferred by age and sex, with regard to epithe-
 ne disease occurring more often in middle and advanced life,
 commonly in males than females.

tion of cancer of the tongue is an important factor in its
 e question of operation—averaging fifty-seven weeks; the
 d having been fourteen weeks, and the longest beyond six

ST.—Any cancerous disease of the tongue must be extirpated
 eration; no known medicinal treatment having any curative

excision of the tongue may be accomplished, either by re-
 h the mouth—the oral operation; or through the cheek, by
 the angle of the mouth, to reach the tongue—the buccal
 by incisions under the jaw—submental operations.

operation.—This procedure—as suggested by Sir James Paget
 rst dividing the attachments of the tongue, the genio-hyoglossi
 ecting it to the jaw in front, and the mucous membrane at the
 the organ can be thoroughly drawn forward. Strong curved
 d from under the tongue through its substance, on either side
 a, and emerging on the upper surface. Then the loop of the
 f the galvanic wire-cautery, is cast around the tongue, behind

Partial excision—through the mucous membrane recommended by Mr. Murrell-Baker; and any jagged teeth likely to be in the way, are extracted. Two threads are passed through the tip and half an inch on each side of it. The thread in the middle is now given to an assistant holding the other, scores the dorsum of the tongue with a scalpel, exactly in the middle line—the mucous membrane into the surface of the tongue is then freely drawn to and through the tip, and the thread is then taken both threads, one in each hand, and pulled in the same way that he would for tightening a rope, splits the tongue into two halves. The middle half of the tongue is now pulled quite up to the tip. The operator, with blunt-pointed scissors, snips off the tip, and the mucous membrane and muscular tissue with the anterior part of the lower jaw. The operator then "runs" the scissors along the floor of the mouth, keeping close to the mucous membrane, keeping close to the floor of the mouth, beyond the level of the posterior edge of the tongue sufficiently, one, and sometimes two, and sometimes now made to perforate it at some distance behind the cancerous mass; and the loop (being probably the best material) is now passed through the tongue, and adjusted behind the need. The *other half* may be removed in like manner.

2. *Buccal Operation* (the Author's).—The angle of the mouth to the inner concave of the tongue is easily reached; then, the tongue is drawn out, and with a vulsellum, the base is transfixed on either side of the cancerous mass.

The puncture and *écraseur* operation, devised by Mr. Nunneley, is performed. The tongue having been transfixed by a couple of curved needles, passed from the floor of the mouth and projecting over surface of the tongue, which has been drawn forward with a force, as in the preceding operations, a stout-bladed needle, attached to the noose of an *écraseur*, is thrust through the floor of the mouth under the chin, the needle being made to penetrate in the middle, and about midway between the os hyoides and the chin, so that it emerges in the mouth by the side of the *frænum* of the tongue; the *écraseur* is drawn up and the needle detached; then the tongue is drawn forward through the noose, which must be planted behind as usual, and the organ is excised by slowly working the instrument. This operation has proved very effectual as a method of complete excision; it is far more conservative than either of the remaining submental operations, both of which will probably fall into disuse.

Engoli's operation;—simply an incision into the floor of the mouth, under the jaw, from one angle of the bone to the other; a second incision in the middle of this, from the hyoid bone forwards, will draw the tongue to be more readily drawn downwards through the opening, nearly the whole organ can then be removed.

Wym's operation consists in making an incision through the middle of the lower lip and carrying it over the chin down to the hyoid bone; the bone of the jaw is sawn through, and the mylo-hyoid, genio-hyoid, and diglossi muscles separated; the two halves of the bone are drawn apart and the larynx is drawn forwards, thus exposing the whole tongue and its very root,—the hyoid attachments. The organ is then to be easily excised; and the symphysis wired together, as more recently done. The lingual artery should be ligatured and divided on either side, in order to reduce the amount of hæmorrhage.

Erectile Tumour or Nævus of the tongue is an uncommon kind, and does not attain to a great size. Removal can be effected by ligature, or, preferably, by ligature; and it may be necessary to reach the portion of the tongue through an incision in the mylo-hyoid

Ranula is a semi-transparent, bluish-white, fluctuating, cyst-like swelling situated under the tongue, to one side of the *frænum*, corresponding to the position of the submaxillary gland. The swelling is attributed to dilatation of the duct—Whartonian duct—of this gland, which presents an enlargement.

It may form, in the same situation, from, perhaps, five sources—(1) dilatation of Wharton's duct; (2) dilatation of one of the sublingual ducts; (3) enlargement of a mucous follicle; (4) enlargement of a bursa mucosa, situated on the outer surface of the genio-hyoglossus muscle; and (5) multilocular cysts, single or multilocular.

The same SYMPTOMS arise from any such swelling; the tongue is pushed forward and backwards, or sideways, thus interrupting speech and deglutition. An ordinary ranula attains the size of a marble or a chestnut. An *intra-bursal* presents an elastic swelling more under the side of the jaw, and attains to a larger size, that of an orange or larger. The contents of these cystic swellings differ: a dilated Whartonian duct or an *intra-bursal* ranula contains a clear, glairy fluid, like white of egg, with,

perhaps, phosphatic concretion; an enlarged *mucous follicle* is filled with a putty-like matter, consisting of epithelial scales with granular fat; while an enlarged *bursa* contains a clear, serous fluid, occasionally tinged with blood.

TREATMENT.—Ordinary *ranula* may be made to disappear by introducing two or three threads of *seton* through the front of the sac; the ends are loosely tied, cut off, and the seton left in the mouth. Or the sac may be *snipped* with scissors, making a button-like aperture, and the interior touched freely with nitrate of silver.

Mucous *cysts* are generally loosely attached, and can be dissected out entire. Enlarged *bursa*, forming in the neck, can be evacuated by a trocar, and injected with dilute tincture of iodine. Or the seton may be here employed. *Congenital* cysts may be dealt with in like manner; but, when of large size, a seton will be safer than the inflammation set up by injection.

Salivary Calculi.—Concretions, consisting chiefly of carbonate of lime, sometimes form in the ducts of the salivary glands—the sublingual, the submaxillary, or the parotid. The *obstruction* thus offered to the free flow of saliva is attended with more or less dryness of the mouth, especially in the act of mastication, when the gland affected becomes swollen and tender, from the retention of the salivary secretion. A *small, hard lump* may be felt in the occluded duct. This must be removed by a *small* incision, to extract the concretion with fine serrated forceps.

CHAPTER XXXIX.

DISEASES OF THE JAWS.

Injuries.—See FRACTURES and DISLOCATIONS.

Fissure of the Palate, or Cleft Palate.—This congenital malformation consists of a mesial fissure of the uvula alone, or of it and the soft palate; extending sometimes along the hard palate, and occasionally forwards to the upper lip, thus presenting the concomitant condition of single or double hair-lip. Rarely the lip and hard palate are fissured without involving the soft palate.

On opening the mouth the fissured condition is at once seen, and its obvious interference with speech and deglutition is readily elicited; the patient speaking with a snuffling, nasal tone of voice, and in the act of swallowing fluids some of the fluid regurgitates, and may escape through the nose.

AGE FOR OPERATION.—Successful results have been obtained in children as young as three years (Billroth succeeded in one instance, the child being under twelve months, without chloroform), but it is not generally advisable to operate earlier than this; although the earlier the operation be performed the less will be the impediment in the patient's speech.

OPERATION.—The patient being placed upon a table in a good light, and chloroform having been administered, the mouth should be opened

g. The *first step* in the operation consists in passing a *knife* behind the palate, first on one side and then on the other, pressing it outwards so as to divide the levator palati as it crosses the pterygoid plates. This often causes sharp hæmorrhage, and the mouth should be kept clear of blood by being frequently swabbed with sponges. Should the palato-glossus or palato-pharyngeus be divided, any action on the sides, their fibres may be snipped with the scissors, the half uvula being drawn towards the median line with the forceps, in order to make the muscles tense. Latterly, however, on account of the difficulty of certainly and safely dividing these muscles, most Surgeons make a free incision through the palate from before backwards, as far as the *edge* of the cleft as possible, so as to *relieve all tension*, at the same time not to endanger the vascular support (Fig. 92).

FIG. 92.



The *second step* consists in paring the edges of the cleft with a fine narrow-bladed *scalpel*; the *shaving* is sufficient—and to effect this is to seize the one side of the uvula with a pair of fine hooked forceps, entering the point of the knife, and drawing it back towards the apex of the cleft. Repeating this on the other side, the superfluous piece may frequently be removed. When the cleft is deep, it may necessitate much dissection, the steps of the operation may be repeated, and the edges of the cleft pared last. This prevents the bruising of the freshly cut edges by the sponges used during the operation.

If the hard palate only be involved, the *third* and last *step* in the operation consists in passing the stitches and bringing the raw edges together, and closing the wound. Fine silver wire, horse-hair, and silkworm gut are all used; instead of silk sutures, the silver wire being preferable.

Various instruments have been devised for introducing the silver wire, but the simplest, and in the end the shortest, method is to pass silk through the mouth, and then, instead of knotting it, as in the description given below, to attach the wire to one end of the silk; and so, by drawing the wire through, substitute it for the curved needle set in a handle, with an eye close to the point, and a waxed thread of fine suture-silk (or silkworm gut may be used) passed from below upwards, about one-eighth of an inch from the edge of the fissure; the thread is seized with forceps close to the needle, and drawn as a double thread out of the mouth, with the ends also hanging out, when the needle is withdrawn, leaving a double thread through that edge of the palate. A similar double thread is passed from below upwards, through the other margin, at the same time as the cut surface and *exactly opposite* the first thread. Thus, a double thread through each side of the fissure (Fig. 93). The first loop, A, is next passed through the right, B, and on pulling the right thread, C, C, the left is drawn through the right side.

FIG. 93.



deal of swelling generally follows, and together, their mutual pressure will union.

Many Surgeons still use the silk suture detailed above, and remove them on the edges of the wire are that the stitches cause little or no irritation, and to any degree of tension by means of the

In cases of complete cleft of the hard palate be not too wide or too deep, it is impossible to obtain complete closure. Surgeons merely attempt to close the

have been loosened in this way, the edges of the cleft can be brought together. In order to remove all tension, the alveolar sulcus could be extended downwards and backwards into the soft tissue. In doing this, the attachments of the palate to the hamular process could be cut through. The posterior palatine artery should be ligatured if possible.

It is important that the patient should be in a good state of general health at the time of the operation,—more especially free from cold, as any increase of secretion in the nares tends to ooze through between the flaps at the recent primary union.

During the first week after the operation, the patient must not speak, but must remain perfectly quiet in bed (if able to write should be provided with pen and pencil), with the head low, so that any mucus forming in the mouth may run back into the pharynx. A fluid diet should be ordered, consisting of beef-tea, eggs beaten up, and plain soups taken cold, for the first four hours.

Improvement in the speech is generally slow, but much may be gained by practice; the patient being taught to open the mouth wide, and to pronounce each letter distinctly, with the nostrils kept closed by the fingers. (W. Rose.)

POST-OPERATIVE TREATMENT.—The operation for cleft-palate not unfrequently results in union, but leaves a *tight* and scarcely movable velum, which interferes with movement in speech or deglutition. In perforations of the hard palate, caused generally by *syphilitic* ulceration, no operation for union can with any confidence be recommended, for the loss of the bone is so decided, and the patient's general constitution so depraved, that union can hardly be looked for. As a *substitute* for any operation, a procedure to effect the closure of Cleft Palate, an *artificial palate* may be used with much advantage. The palate or obturator is made of metal plates, usually of gold or ivory plate, caoutchouc, etc. Obviously, no plate could be worn continuously, which can obstruct the development of the jaw in childhood, or cause absorption of the natural bone, and thus enlarge the fissure.

DISEASES OF THE JAWS.—Necrosis.—The Jaws are subject to necrosis at least three causes: Syphilis, Exanthematous poison, and that of scarlet fever, and Phosphorus. But ulcerations of the tongue, scurvy, cancrum oris, or mercurial salivation, may also result in the loss of some portion of the bone. Commencing, usually, as periostitis, it takes place beneath the periosteum, followed by necrosis. The lower jaw is affected more commonly than the upper. *Abscess* tends to form chiefly along the lower margin of the inferior maxilla, or the abscess extends into the neck; whereas the abscess finds its way more to the mouth, from the superior maxilla. The teeth loosen, and though sometimes remaining unaffected for a long time. In the upper jaw, the permanent teeth may be cut as usual; the pulps having been destroyed, and thus give rise to the apparent reproduction of teeth. **PHOSPHORUS-NECROSIS** occurs among those whose occupation exposes them to the fumes of phosphorus, as in the making of lucifer matches. To Heath's treatise on "Injuries and Diseases of the Jaws," I am indebted for some of the following particulars relative to this necrosis, and for the diagnosis of Maxillary Tumours.

The mode in which the necrosis is produced, seems to be by the entrance of phosphorus-fumes into the osseous structure of the jaw, through carious teeth or an open socket; the disease never arising when the teeth of the workmen are sound. The liability of the two jaws to the necrosis appears to be about equal, or with a slight preponderance against the lower jaw.

Symptoms.—The same symptoms arise, whatever be the cause of Necrosis; but in that proceeding from phosphorus, they are most marked. Toothache, intermittent at first, becomes continuous; the teeth loosen, and pus exudes from the sockets. The gums are swollen and tender, and detached more or less from the alveoli. Swelling of the face takes place; one or more fistulous openings discharge pus, and lead down to bare and dead bone.

Death may, at length, take place from exhaustion, or rapidly from gangrene of the cheeks and lips; recovery occasionally ensues, with considerable loss of bone and deformity. The repair, after necrosis of the jaw, is sometimes very complete, the formation of new bone being very prolific. A pumice-stone deposit of bone on the sequestrum is almost constant, and has been erroneously regarded as characteristic of phosphorus-necrosis. This deposit is derived from the periosteum and the gum, and though resembling true bone, it is decidedly of lower development. It is not found in the disease of the upper jaw. Repair seems to be but temporary; the new bone diminishing by absorption to a certain arch, and ultimately being scarcely sufficient to keep out the lower lip, the chin is quite lost.

Treatment.—The cause of necrosis must, of course, be removed; any exposure to the influence of phosphorus would perpetuate that form of disease. Any decayed teeth or stumps should therefore be extracted, as the source of local irritation. Detergent gargles of chlorinated soda or permanganate of potash may be advantageously used to cleanse the mouth. Opium, to allay pain, with tonics and whatever nutritious food can be taken to support the strength, are the only measures available, pending the detachment of the sequestrum, and the production of an enveloping shell of new bone adequate to maintain the form of the jaw. The sequestrum is then to be extracted through the mouth, if possible, or through incision placed so as to leave the least subsequent deformity. The permanent set of teeth should be preserved, when practicable. "Sub-periosteal resection" has been much advocated by foreign Surgeons; but the operation does not apparently differ from the extraction of sequestra, as ordinarily practised.

Abscess of the Antrum.—Arising from the irritation of carious teeth, which may be in immediate relation to the antrum, or unconnected with that cavity, as the incisor teeth, the disease commences as alveolar abscess, which bursts, directly or indirectly, into the antrum. But abscess of the antrum may result from catarrhal or other inflammation of the lining membrane; or it may be of traumatic origin,—the extraction of a tooth communicating with the cavity, the entrance of a foreign body, a blow on the cheek, or injury received during birth in a pubic presentation.

The Symptoms are, at first, those simply of inflammation of the lining membrane; dull, deep-seated pain shooting up the face and to the forehead; swelling and tenderness of the cheek, with considerable fever and

mal disturbance. Generally the pus, not finding a ready exit, bulges the antrum; bulging out the cheek, uplifting the floor of the mouth, pressing the hard palate, and loosening the teeth, obstructing the mouth and closing the nostril. The wall of the cavity undergoes necrosis, and becoming thinned, it yields a peculiar *parchment-like* consistency under pressure with the finger. The matter may burst externally into the mouth or into the nostril; in either case considerable swelling and scar will probably be the result.

TREATMENT.—Any carious teeth or stumps must be extracted. This is followed by a flow of pus, when the introduction of a trocar into the alveolus will completely evacuate the matter. When all the teeth are apparently sound, the first molar tooth should be extracted, as the deepest socket and being most liable to decay, and then the next should be punctured.

Drainage of the Antrum.—Care should be taken in using the trocar, not to penetrate with a jerk and injure the orbital plate. The alveolus should be punctured above the gum, and this will be necessary in cases of suppuration occurring in old people, after loss of the teeth. The cavity should then be cleansed by syringing with warm water, by means of a curved cannula and hydrocele elastic bottle. A slightly astringent gargle may be advisable; and a weak solution of permanganate of potash or of zinc answers admirably. The entrance of any particles of food should be prevented, by plugging the aperture with cotton-wool. In examining the antrum, the possible subdivision of this cavity, owing to the presence of bony septa, will be an obviously important condition; and with reference to the extraction of a foreign body, as the fang of a tooth, lying in one of these subdivisions.

Alveolar Abscess.—An abscess of the antrum, producing a slow expansion of this cavity, may be mistaken for a *solid growth*; and particularly when there is considerable hypertrophy of the osseous wall, in consequence of protraction.

Alveolar Abscess.—**Gumboil**, or **Parulis**, as it is technically called, is the simplest and commonest form of this abscess; occurring as a swelling of the gum around a tooth, usually carious.

Location of the opening is diagnostic of the source of abscess—alveolar tooth affected. In the *upper* jaw, alveolar abscess appears on the cheek at a point corresponding to the extremity of the tooth's root, or the edge of the malar bone; in the *lower* jaw, it forms along the edge of the jaw below the buccinator muscle when the molars are affected; and when proceeding from the inferior incisors, generally beneath the chin, a large pad of granulations forming, like a thumb-nail, from the centre of which the discharge issues. In children, with the milk teeth, alveolar abscess seldom, if ever, opens.

Diagnosis of alveolar abscess, as above determined, is important; not to mistake it for diseased bone, nor to attribute an abscess to carious teeth which may be coincident, but not the cause.

TREATMENT.—Warm fomentations afford relief and bring the abscess to the surface, and incision through the gum or cheek will then evacuate its contents, but extraction of the diseased or dead tooth is the only certain

Tumours.—The Gums or the Jaws may each be the seat of or in the production of Tumours, a distinction obviously of great practical importance.

(1) **Epulis.**—This is either a simply *fibrous*, or a *myeloid* and recur form of growth, springing apparently from the *gum*, but as myeloid epulis more deeply, from the *periosteum* of the *alveolus*, externally or internally within the tooth-socket. The adjoining bone is very vascular. Present usually, at the edge of the *alveolus*, between two standing teeth, and more commonly on the labial or buccal aspect than towards the tongue, the tumour grows slowly, displacing and loosening the teeth, and somewhat expanding the alveolar border. It is *broad based*, slightly lobulated, and *elastic*, smooth, red, painless, and little inclined to bleed, resembling the adjoining gum. It attains to a limited size, varying from a pea to a walnut or larger, or possibly to a remarkable size, with protrusion, presenting an everted appearance. The *upper jaw* is more frequently the seat of epulis than the lower jaw, in, perhaps, the proportion of two to one.

The **DIAGNOSIS** of this kind of growth is simple; *hypertrophied gum* in the form of loose flaps and masses, known as *polypus* and *fungus of the gum*, and occurring in connection with decayed teeth, exhibits the appearance with which the growth can possibly be confounded. The relation of epulis to the presence of teeth, as a cause, may be thus stated. Generally making its appearance where there are teeth, the growth usually invades one, far more than the adjoining teeth; although caries of the tooth has no apparent causative influence, and occasionally the tumour appears in an edentulous portion of gum.

Ulceration of the surface of the tumour and discharge may ensue, but these or other changes seem to result from external agencies.

TREATMENT.—Early and complete *extirpation* with the knife is the only permanent cure. This is accomplished by extracting the tooth, the teeth, excising the tumour clean down to the bone, and then removing with cutting-pliers or small saw the portion of alveolar process corresponding to the base of the growth, and whence it sprang.

(2) **Tumours of the Jaws.**—**HYPEROSTOSIS**, or simple osseous hypertrophy, and various morbid growths or tumours are liable to form in or in connection with the Jaws, as in other parts. Thus, **FIBROUS**, **CYSTIC**, **CARTILAGINOUS**, or **OSSEOUS**, **VASCULAR**, or **Erectile**, **SARCOMATOUS**, or **CANCEROUS** tumours, as comprising **Squamous** and **Columnar Epithelioma** have severally been met with. **Encephaloid** or medullary cancer was usually be regarded as a form of sarcoma—the round-celled variety.

The **Pathology** of all these morbid growths differs in no essential particulars from that of the same growths in other situations.

Their **DIAGNOSIS** is practically unimportant, excepting with reference to the distinction of Cancerous or Sarcomatous and Non-malignant forms of maxillary growths. The *extent* of the tumour is also a moot question of examination—especially with regard to the upper jaw.

In examining any tumour of the **UPPER JAW**, a careful inspection and palpation, as far as possible, should be made of the face, mouth, and nose. In making a rhinoscopic examination, the nares should be illuminated by the laryngoscope. A small mirror is placed at the back of the throat at such an angle that luminous rays falling on it are reflected into the nares, whilst the image formed in the mirror is seen by the observer. An undisturbed

thus be clearly distinguished from a polypus springing from the bones, or a growth springing from the base of the skull. The hard and soft palate should be examined with the finger, the soft palate to ascertain any extension of the growth in. By anterior rhinoscopy, or inspection through the nostrils, it may be taken of an antral tumour, and which perhaps can be felt by the little finger up the nares. The consistency of the projection of the teeth is more readily discovered, and the finger should be inserted both outside and inside the cheek.

Early stage of a tumour in, or adjoining, the upper jaw, the growth produced may present characteristic appearances. When the tumour is within the jaw, as an antral tumour, a general expansion of the face appears—in the cheek, orbit, nares, and perhaps the roof of the mouth—the line of teeth being also irregular. But, when the tumour is behind the jaw, in either of the fossæ—spheno-maxillary, or maxillary—there is no expansion of the antrum, nor any irregular surface, but only a protrusion or bulging of the jaw. A tumour arising from the malar bone produces an elevation of the cheek, with protrusion forwards, and presents also in the mouth above the gums and teeth.

Diagnosis.—*Non-malignant* growths are more or less hard to the touch, painless. They grow slowly, and have no tendency to involve the parts of the skin, except by mechanical interference; the general appearance remains unaffected. *Encephaloid cancer* is characterized by its rapid gnawing pain affecting the face and head; its rapid growth, tendency to fungate and bleed. Puncture with a grooved awl will not distinguish whether a tumour be solid or fluid, but a small portion of the growth may thus be procured for microscopic examination. Sometimes, removal of a tooth may carry off with it a little bit of the growth, and the escape of fluid from the antrum, declare the nature of the disease.

Signs of the LOWER JAW are more open to *DIAGNOSIS*. *Non-malignant* growths are distinguished by hardness, and slowness of growth, tendency to fungate within the mouth, and no enlargement of the lymphatic glands. After a time, the unchecked growth may protrude through the skin and present a fungating mass; but this has a more tardy appearance and is of slower growth than a malignant fungating tumour. *Cancerous* tumours generally originate within the bone, and are of rapid growth; tumours having these characters are almost invariably malignant.

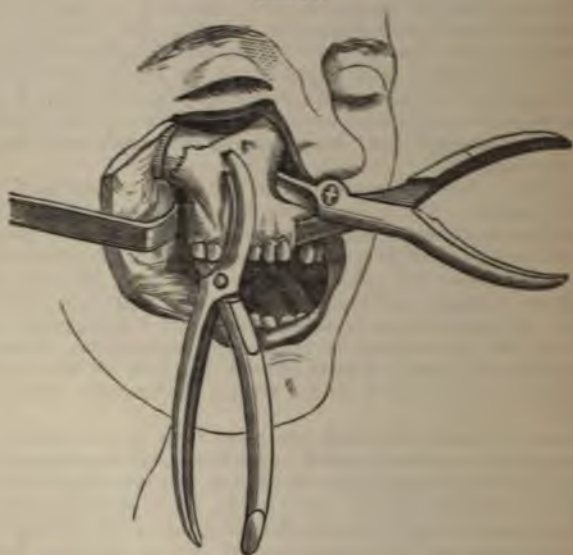
Treatment.—Early and complete *Excision* of the growth is the only method of cure in *non-malignant* tumours, before the *anatomical relations* of the disease become too complicated to admit of complete extirpation; in *malignant* and *Cancerous* tumours, before the surrounding structures have been involved.

Results of such operations are more successful in respect to tumours of the jaw, as the whole disease can be more completely removed.

Operation of the Upper Jaw.—Of several methods of operation, that is generally applicable is as follows:—The patient sitting, or bent and under the influence of chloroform, the central incisor of the diseased jaw is extracted, and two incisions are then made.

First, a bistoury is entered at the junction of the malar and upper maxilla bones, and carried just below the orbit, across to the nasal process of the maxilla. Secondly, another incision is made from the nasal process down along the side of the nose, round the ala, which it detaches, and perpendicularly through the centre of the upper lip into the mouth (Fig. 94). The flap, thus defined, is dissected down, the eyeball and its surroundings being cautiously raised from the floor of the orbit, protected by a curved retractor held by an assistant standing behind over the head of the patient. The bones are then divided by strong cutting-pliers; the junction of the malar bone first, then the nasal process, one blade of the pliers being

FIG. 95.



inserted into the orbit—the eye still protected—and the other into the nose; and lastly, the alveolus is notched with a narrow-bladed saw, where the incisor tooth was extracted, and the palatine arch divided by passing strong, sharp cutting-pliers—one blade into the mouth and the other into the floor of the nose. Weiss's "eccentric-jointed" pliers is the form of instrument (see Fig. 95) which works with the greatest facility. The palatine plate of the palate-bone with the velum palati, or soft palate, should be left untouched, if possible. The osseous mass, thus detached from its connections, is drawn downwards and forwards, with the ligature forceps, and easily removed. Ligatures must be applied to the internal maxillary or its branches; any other vessels which cannot be thus secured may be seared with Paquelin's cautery. The large cavity exposed is sprinkled with iodoform, and then plugged with antiseptic wool from

the flap of integument replaced over it, and retained in position in the cheek, the upper lip being accurately closed with twisted suture for hare-lip. No portion of integument should be pared off, so that it may at first appear; having been stretched over the wound, it will contract and pucker up. The ultimate disfiguring from this operation is comparatively inconspicuous.

Malar bone may be involved in the disease, with the whole of the maxilla; then the zygoma and junction of the malar with the angular process of the frontal bone, must each be divided with the pliers, and the operation completed as for removal of the maxilla alone.

Malar bone and the *orbital plate of the superior maxilla*, forming the floor of the orbit, may be sound; then, a groove having been made with the saw, across from the nasal process of the maxillary to the angle of the malar bone, the separation is completed with the forceps, and the remainder of the bone as above described.

A single naso-labial incision—without the infra-orbital, I have rarely the whole of the antrum, with the alveolar border of the jaw. The dangers incident to excision of the upper jaw are: hæmorrhage—primary and secondary; entrance of blood into the trachea; and shock.

Feeding vessels may usually be commanded by ligature or cautery. Compression of the common carotid may be employed with advantage during the operation; and afterwards, in the event of secondary hæmorrhage. But ligature of the main arterial trunk may become necessary as the only means of arresting secondary bleeding. *Tracheotomy* is requisite, to prevent the risk of asphyxia, from blood trickling down the glottis; and Trendelenburg's trachea-tampon precludes the entrance of blood into the bronchi.

Excision of the Lower Jaw.—PARTIAL removal of this bone will suffice—the disease being situated on one side, and between the angle and angle of the jaw, or involving the ramus, or extending to the symphysis on the other side.

THE removal of the jaw, by disarticulation at the temporomandibular articulation, on either side, is rarely rendered necessary by the disease.

In any such operation, partial or entire, is the same. The diseased bone, with the most facility and least deformity. An incision under the chin, along the body of the mandible, answers both purposes.

PARTIAL EXCISION—say, of one-half of the jaw—is performed as follows: The point of a scalpel should be entered behind the articulation, and carried down the posterior border of the ramus behind the ear along under the body of the bone to the chin, and curving forward terminates about an inch from the margin of the lip (Fig. 96). In the course of this incision, the facial artery will be divided, but the vessel is avoided. The former is at once ligatured. The flap is then thoroughly exposing the tumour, the knife passed under it into the mouth and along the jaw, keeping close to the bone, and lifting the mucous membrane. The central incisor tooth of the lower jaw having been extracted in commencing the operation, the jaw is to be sawn through with a small, narrow-bladed saw, having a

de. Whenever the operation extends beyond the symphysis, a division of the muscles on either side, which pass from the tongue, this organ must be secured and drawn forward by a ligature previously introduced through the tongue, and thus assisted. Otherwise, the tongue, loosened anteriorly, may be drawn into the pharynx—swallowed, in fact, and threaten, or actually suffocation.

THE ENTIRE JAW can be removed *en masse*, by an incision carried to a disarticulation corresponding to that for the removal of half (See Fig. 96.)

REMOVAL OF THE UPPER, OR THE LOWER, JAW—during the process of granulation, the patient must be fed with liquid food, spooned into the mouth or sucked through a tube. A dense fibrous tissue gradually forms a kind of substitute jaw; and, especially when the articulations of the jaw are left untouched, the movements and appearance of the face are far more perfect than might be expected.

THE NECK.

CHAPTER XL.

INJURIES OF LARYNX AND TRACHEA, PHARYNX AND OESOPHAGUS.

OF THE LARYNX AND TRACHEA.—No department of Surgery demands greater care of action on the part of the practitioner than that which relates to the larynx and trachea; so that, being thrown on his own resources, ready knowledge is here more especially requisite.

INJURIES OF THE LARYNX sometimes occur, in the form of compression of the laryngeal cartilages; the former lesion mostly in children, when the cartilages are soft and yielding; the latter injury in persons of advanced age, when these structures have undergone a degree of ossification.

LARYNGEAL INJURIES are produced by some mode of direct violence; by strangulation or garotting; or from a powerful blow or fall on the box of the larynx.

DANGER OF laryngeal compression or fracture is that of suffocation; in one case, there will be less risk of immediate asphyxia, unless the compression be prolonged; for the laryngeal cartilages recover their shape and position, as soon as the cause is removed. Asphyxia ensues in consequence of either form of injury; owing to extrusion of blood in the laryngeal mucous tissue, or from inflammatory

effusion therein as œdema glottidis, or simply as a spasmodic affection induced by irritation.

TREATMENT must have immediate recourse to the measures appropriate for the prevention or removal of these contingencies, interstitial hæmorrhage, inflammation, and spasm. Hence the application of leeches to the throat, cold lotions or warm fomentations, with some general lowering treatment and anti-spasmodics. In the event of impending suffocation *tracheotomy* must be performed.

Wounds of the Throat.—These injuries are inflicted commonly with suicidal intent, and usually therefore with a cutting instrument, as a razor or knife; forming the wound ordinarily known as “cut throat.” The wound is a transverse and upturned incision, somewhat jagged or lacerated and varying in depth and extent.

(1.) It may be a *superficial* wound, dividing only the integument, and to a limited extent, in front of the throat; or extend across the throat, from side to side, or ear to ear, and sever the carotid vessels—artery and vein, with perhaps the pneumogastric nerve—on one or both sides, and if sufficiently low down in the neck, the phrenic nerve may be touched. An integumental wound, commencing on one side of the throat, may divide these vascular and nerve trunks on that side; but a wound sufficiently resolute to extend to the other side—cutting the throat, as it is popularly termed, from ear to ear—and dividing the vessels on both sides, will scarcely be effected without involving deeper parts.

(2.) A *deep* wound involves the air-passages, and perhaps the pharynx or œsophagus. The appearance and functional phenomena differ somewhat according to the situation of the wound. It may be *above the hyoid bone*; thus opening the mouth under the tongue, which perchance will be touched, and the power of deglutition is lost. Or, the wound may pass across the *thyro-hyoid space*, above the larynx, the commonest situation; opening the *pharynx*, and perhaps shaving off the epiglottis or touching the glottis itself, and here also deglutition is incomplete. Or, the *larynx* may be divided anteriorly, exhibiting a transverse gap, through which the air issues during each expiration, with a rushing, bubbling sound, and with almost sufficient force to blow out a candle if held near the aperture. The voice is lost or reduced to a broken whisper, but it is restored on closing this opening in the windpipe. Similar phenomena are observed when the *trachea* is opened. The *thyroid body* will be almost necessarily involved, an important source of hæmorrhage. The *œsophagus* can be opened only by a deeper wound, passing through the trachea. But, in rare instances, both windpipe and gullet have been divided down to, and implicating, the *vertebral column* beneath. The windpipe is usually cut in front and high up, the suicide imagining that a wound of the air-passage is mortal; and thus the prominence of the larynx mostly invites the attempt. Hence also, the great vessels and nerves, on either side of the throat, providentially escape injury.

CONSEQUENCES AND PROGNOSIS.—1. *Hæmorrhage* is the immediate source of danger. It may be *venous*; proceeding from the plexus in front of the trachea, or from the internal jugular vein. The carotid trunk or its branches are the source of *arterial hæmorrhage*; the trunk must be wounded if the jugular vein be implicated, and above the hyoid bone, a cut throat will probably divide either or both lingual arteries. Death may

ly ensue, directly from hæmorrhage, or from the blood trickling into windpipe, producing asphyxia, or inflammation of the lungs at a later time. Occasionally death arises from the accidental sucking up of air into the veins, inducing asphyxia. Division of a *large nerve*, the pneumonic or phrenic, occurs usually in conjunction with wound of the larger vessels; and division of the phrenic on one side only may be almost immediately fatal, either by partially suspending respiration, or in consequence of inflammatory congestion of the lungs. 2. *Asphyxia*, in connection with a wound of the trachea, may arise, as already stated, from hæmorrhage into the trachea, or from lesion of the phrenic nerve, or from pneumonia consequent on either state; but pneumonia or bronchitis may also result also from the introduction of cold air into the lungs through the wound, by inflammation extending downwards from the wound in the windpipe. 3. *Edema of the glottis* in consequence of inflammation, or the irritation or impaction of a partly detached epiglottis, may severally induce asphyxia, when the wound is above the larynx. Division of the *natural sensibility* of the *glottis*, preventing its efficient action, will allow food to pass into the larynx and through the external opening, without any wound of the pharynx or œsophagus. Mucus also is apt to accumulate in the bronchi, owing to their diminished sensibility. Finally, the respiration may be mechanically impeded *below the epiglottis*; by a partly detached portion of cartilage hanging into a laryngeal or tracheal wound, or by overlapping of the lower portion of the trachea by a foreign portion, when this tube is completely divided.

TREATMENT.—The general indications are—to arrest hæmorrhage, and to restore the patient from *shock*; to *adjust the wound* for reparation, to relieve any difficulty of *respiration*, to administer *food*, and to *avert inflammation* of the trachea or lungs.

(1.) *Hæmorrhage* must be arrested by the ligature of any bleeding vessel, whether artery or vein, so as to prevent any oozing or trickling into the larynx or trachea. The introduction of a silver tube into the windpipe through the wound will obviate the liability of blood being sucked in by the act of inspiration. This should be withdrawn as soon as oozing or hæmorrhage has ceased. (2.) The *shock* in cases of cut throat is often considerable, owing to the despondent state of the suicide, and sometimes to the vicious habits of intemperance. Hence the judicious administration of stimulants may be requisite. (3.) The *wound* should be adjusted by the knife, rather than by sutures. An *integumental* wound may be advantageously united by a few points of suture, throughout its extent. In a *tracheal* wound, involving the windpipe, partial union only can take place, owing to the mobility of the parts subject to the actions of respiration and deglutition; the wound closes chiefly by granulation and cicatrization. If perfect union happen to occur in the central part of the wound, *coagulation* takes place to accumulate beneath, threatening suffocation by pressure upon the trachea, and the wound will have to be reopened for removal. The extremities, or integumental portion of the incision, should be retained together by a suture or two, leaving the central portion open. The head should then be brought forwards, so as to depress the chin against the sternum, and fixed in position by a bandage round the crown of the head, a lateral strip passing down on either side of the face, fastened to a bandage around the chest. If the *trachea* be completely divided, a suture or

two should be inserted into each side of the tube, to retain its ends together. (4.) Difficulty of breathing must be prevented or overcome, by having regard to the circumstances already enumerated which give rise to dyspnea. The temperature of the apartment should be maintained at about 80° Fahrenheit; and the air moistened and softened, as it is breathed through the windpipe aperture, by covering the wound with a piece of muslin loosely folded, beneath which a clean sponge moistened with warm water may be placed adjoining the air-aperture. This aperture must be carefully kept open and free of any clot, or other occasion of impediment to the breathing. To maintain a warm, moist atmosphere, a tent-bedstead of blankets can be readily made, and a tube connected with a kettle, is an efficient steamer. A wound above the larynx, and followed by oedema of the glottis, will necessitate recourse to tracheotomy. (5.) The administration of food becomes a difficulty only when the pharynx or œsophagus is opened. Food is best introduced by means of a large-sized elastic catheter, or the tube of the stomach-pump, passed through the mouth into the gullet below the opening. If this mode of feeding cause great irritation, nutritive enemata may be resorted to. The food is necessarily liquid, let strong beef-tea, soup, or Liebig's *liquor carnis*, milk, eggs beat up with brandy or wine, can be thus administered, and the patient's life indefinitely prolonged, until he is able to swallow without assistance.

(6.) Inflammation, in the form of bronchitis, will probably be averted by due attention, as already directed, to the temperature of the atmosphere which the patient breathes through the windpipe aperture; and pneumonia prevented by watchful observation, more especially with regard to any trickling hæmorrhage into this aperture. In the event of either form of inflammation, the treatment accordingly must be conducted on ordinary principles; taking, however, into consideration the state of the patient, as reduced by hæmorrhage and his depressed mental condition.

The wound, in the course of granulation, requires nothing more than water-dressing, or other simple applications.

ARTIFICIAL FISTULA sometimes ensues; the skin having doubled in and become adherent to the edge of the aperture in the air-tube, a jet of air passes and repasses through, with each act of respiration. This happens most frequently in the thyro-hyoid space. Mr. Erichsen has found the following operation successful in closing such a fistula:—The edges of the opening are to be freely pared, and the knife passed under them for some distance to detach them from the subjacent parts, a vertical incision also being made through the lower lip of the opening, splitting it downwards. Two points of suture are then inserted into each side of the horizontal incisions, bringing their edges into contact; but the vertical cut is left free for discharges and mucus to drain away, and for the expired air to escape, lest emphysema occur. Unless this outlet be left, the sutures will burst, and union of the edges be frustrated. An aerial fistula cannot be safely closed when the larynx above is obstructed, and it may even become necessary to enlarge the opening and introduce a silver tube to compensate for the laryngeal obstruction.

A **STREAK IN THE THROAT**, involving the trachea, presents no peculiarity from an ordinary cut throat; except the liability to emphysema, by escape of air into the surrounding cellular texture, if the wound be narrow and

compression, with a pad of lint, well retained by strips of plaster, usually succeed in overcoming this difficulty.

Foreign Bodies in the Air-passages—Larynx, Trachea, or Bronchi.—Various substances that admit of being swallowed, occasionally pass into the *rima glottidis*, and thence, perhaps, lower down into the air-passages. Any such body is, however, not swallowed into the glottis, in an act of deglutition, but *inhaled* into this opening from the mouth, by inspiration, in the act of laughing or talking with the substance in the mouth. It is drawn by the current of air between the dilated lips of the mouth. Various substances may thus pass the "wrong way"—a bit of cherry-stone, a bean, pea, nut-shell, or a tooth, money, a button, a pebble, a pin, fish-bone, or piece of stick. But, food may pass into the larynx in the act of *deglutition*, from *laryngeal paralysis*, or *asphyxiation*.

Symptoms are those of *suddenly obstructed respiration*, and of those followed by those of *inflammation*. But the symptoms vary in accordance with the *situation* of the foreign body. If impacted in the *rima glottidis*, any substance so placed completely obstructs respiration, and the individual, suddenly turning blue in the face, is almost dead almost instantaneously. Not uncommonly a violent cough or two ejects the foreign body, and the peril is over, but spasmodic coughing still remains for a time, owing to the irritation. In the *larynx*, the foreign body may lodge or hitch in one of the vocal folds, or slip down into the *trachea*; the same spasmodic coughing with great difficulty of breathing and sense of suffocation, and a hoarse, croupy sound is heard through the episternal notch, during respiration, but the voice is broken or lost. All these symptoms are most intense when the larynx is the seat of impaction. In the *trachea*, the foreign body has more room, and the urgent symptoms perhaps for a while; or, the foreign substance moving up and down occasionally, particularly if the patient move, coughing returns with violence, and the body can be heard and even felt to strike the walls, seeming to threaten instant suffocation. (3.) In the *bronchi*, a foreign body is comparatively tolerated; the respiration is more or less unobstructed, and a whistling or murmuring sound may be heard over the affected segment, while the vesicular breath-sound in the lung below is sometimes also, during coughing, the body is dislodged and driven out.

The *right bronchus* is generally that into which the foreign body passes, it being larger, though passing outwards almost transversely; the *left bronchus*, of smaller size, inclines obliquely downwards and more directly in the line of the trachea. According to Professor Wilson, observations, the foreign body has always been found in the left bronchus.

The symptoms of obstruction will vary from time to time, according to the *size* and *shape* of the foreign body; a relatively small substance moving up and down in the air-tube—trachea or bronchus; and a flat body, such as a coin or button, may rotate on its axis, more or less excluding the admission of air.

Diagnosis from laryngitis or croup turns mainly on the history of the case: the apparent introduction of a foreign body in the act of laughing, for example, and the sudden origin of the symptoms on that occasion, constitute the chief points of distinction.

foreign body, and the period of its incarceration. After danger, the greatest risk occurs between the second day and first month; but the mortality diminishes until the third; increases again. The cause of death also varies according to the fatal result. During the first twenty-four or forty-hours happens from convulsions and sudden asphyxia; during the it is apt to occur from inflammation of the lungs; and after have elapsed, death results from hectic exhaustion.

TREATMENT.—The obvious indication is to get the force the windpipe; but the proceeding to be taken should be urgency of dyspnea. (1.) Impaction in the *rima glottidis* when opportunity offers—immediate search below the root with the finger, and extrication of the substance from the larynx. Failing to accomplish its removal, *laryngotomy* must immediately, and a probe passed through the laryngeal apertures to dislodge the foreign body. (2.) Lodgment within *trachea*, may allow of some delay; in order to quiet spasm of muscles, which prevents the ejection of a body, not itself coughed up. With this view, it may be desirable to bring somewhat under the influence of narcotics or chloroform, the body—by holding the patient with his heels upwards and wards, shaking the body at the same time, or slapping probably cause the substance to drop out of the air-pass through the mouth. If suffocation threaten, the attempt should be done. In the treatment of these cases, it should be remembered that the patient experiences the sensation of a foreign body, for some removal. If, therefore, the signs and symptoms of obstruction of the air-pass are not relieved, the foreign body is not removed, and the irritability of the laryngeal mu-

Laryngotomy or tracheotomy should be resorted to in the event of the foreign body still remaining in the windpipe, and the irritability of the laryngeal mu-

the introduction of an instrument will be much facilitated by the state of the glottis.

Diseases of the Glottis, Mouth, and Pharynx—not unfrequently among the children of the poor, in their attempting to drink from out of a kettle containing boiling water. The act of swallowing is incomplete, but the inside of the mouth and pharynx are scalded, and the glottis is speedily induced; the interior of the larynx remains unaffected. A similar state may be produced by the inhalation of the explosion of gas or fire-damp.

SYMPTOMS are, immediate and urgent suffocative cough, and difficulty of breathing; and the appearances are, puffed and turgid lips, the interior of the mouth and fauces having a whitened and soddened aspect. Death soon follows, perhaps from shock, or unless the inflammation be relieved.

TREATMENT.—Leeches to the throat, and small, repeated doses of opium and opium, may succeed in reducing the œdema; but the urgency of dyspnoea will probably necessitate *tracheotomy* without delay, as the chance of safety; and a tube must be introduced into the trachea and retained there, until this has subsided under the continuance of medical measures. The operation is rendered more than usually difficult, by the shortness, fatness, and turgidity of the neck, and small size of the trachea. The result is generally fatal, from the supervention of pneumonia or pneumonia.

Some mineral acids are occasionally swallowed, either with suicidal intent or by accident. The effects of such fluids, as sulphuric acid, are similar to those produced by boiling water, the mucous membrane of the mouth and pharynx becoming whitened and corrugated, with some tendency to glottitis. *Tracheotomy* may be requisite.

Asphyxia or Apnoea.—These terms are used to signify impeded or arrested Respiration.

SYMPTOMS.—*Dyspnoea* or difficulty of breathing, as indicated by the respiratory movements; which, at first short and rapid, soon become deep, slow, and prolonged, with a gradually widening interval between them, until before they entirely cease, when they again diminish in force and number. The circulation of blood undergoes concurrent changes; the action, at first accelerated, in a few seconds becomes slow, laboured, and feeble, till the pulse ceases to be perceptible at the wrist. The heart, however, still beats, audibly to the ear, and palpably to the hand, applied to the chest; this action gradually becomes less and less distinct, till it finally stops at a period within ten minutes after the first interruption to respiration. The period that elapses between the last respiratory effort and the cessation of the heart's action, varies from two to four minutes. The symptoms accompany the circulatory changes, and in somewhat the following order:—a sensation of fulness in the head, and giddiness, ringing in the ears, and flashes of light dancing before the eyes; then a pleasing, almost voluptuous dreams, which soon fade away into insensibility and unconsciousness, speedily succeeded by convulsions. The appearances of the person undergoing asphyxia are peculiar; an extremely pale expression of countenance, blueness of the lips, starting of the eyes, distension of the vessels of the face, head, and neck, frothy mucus, usually sanguineous, about the mouth, involuntary passage of the

feces and urine, and sometimes an emission of semen with or without erection.

All the symptoms are modified and proceed more or less rapidly, according to the cause of asphyxia.

The CAUSES of asphyxia may be arranged under four general heads: (1) A mechanical impediment to the entrance of air into the lungs; (2) drowning; (3) the absence of oxygen in the respired gas; (4) inhalation of a toxic vapour, associated with an absence of oxygen.

TREATMENT.—The primary indication is to arterialize or oxygenate the blood as soon as possible; this implying the restoration of respiration, and circulation—by certain resources—any adverse condition having been previously removed.

ARTIFICIAL RESPIRATION.—This may be effected by various apparatusless means, and which, therefore, are always applicable.

(1.) By simultaneous pressure on the abdomen and thorax, alternated with relaxation, twenty or thirty times *per minute*. The compression should be made over the lower part of the sternum and upper and middle part of the abdomen, so as to partially expel the air from the thorax, without allowing any counteractive effect by descent of the diaphragm; the resilience of the thoracic walls enables the air to rush into the lungs, and then compression is repeated. If food be forced up from the stomach, the patient should be placed on his face for a few seconds, while any such matter is expelled, lest it pass into the windpipe.

(2.) *Silvester's method*—or the "physiological method"—consists in the imitation of the natural action, as during deep inspiration, of the pectoral and other muscles passing from the shoulders to the walls of the chest. Inspiration is imitated by slowly extending the arms upwards by the sides of the head until the elbows nearly touch each other; expiration is then performed by simply restoring the arms to the sides of the chest, and pressing them against it.

The *Circulation*.—Restoration of this function is partly effected by that of respiration—by arterialization of the blood and by the respiratory movements. But certain special means of *stimulation* should also be resorted to; such are warm frictions all over the body, and more especially of the limbs; warm coffee or tea, and brandy, when the patient can swallow, should be administered, or previously by the stomach-pump, and stimulant enemata; a warm bath, not above 106° Fahr., will also be requisite, when the temperature of the body is much reduced, as by drowning in the winter season. Artificial respiration by pressure can be readily applied while the body is in the bath.

As soon as the natural respiratory movements recommence, artificial respiration may be discontinued, or renewed only to aid the efforts when feeble and imperfect.

TREATMENT after NATURAL RESPIRATION.—The following directions are appended by Dr. Harley:—(1.) Give the patient some warm nutriment, to which a small quantity of stimulant is added; beef-tea, chicken-soup, coffee, or tea with one or two tablespoonfuls of brandy. (2.) Put him into a well-aired bed, with hot bottles to his feet, and encourage sleep. (3.) Let him be carefully watched during sleep in case of secondary apnoea; at the slightest symptoms of which let gentle frictions and, if necessary, artificial respiration be again had recourse to. Give volatile stimulants, such as the *spiritus ammoniæ aromaticus*, or *sp. ætheris nitrici*.

case of the *Drowned*, the following might be said to be the four modes of treatment:—(1.) Empty the air-passages of all the water & mucus they may chance to contain, by holding the legs and head higher than the head. (2.) Wipe the mouth and nostrils dry. (3.) Turn the tongue forward. (4.) Use artificial respiration.

Pharynx and Œsophagus.—Wounds of the gullet occur, most frequently, in connection with cut throat, as a complication of this form of

Foreign Bodies.—Various substances are liable to become impacted in the pharynx or Œsophagus; some of which obstruct the passage by their bulk, as a lump of meat; others impinging, by their pointed shape, as a pin, or owing to their irregular form, as a set of artificial teeth. The most common case, has been dislodged into the gullet. The substances stick either in the pharynx, about opposite the larynx, where the tube is narrowed at the commencement of the Œsophagus; or, lower down, towards the cardiac orifice of the stomach.

SYMPTOMS are those of choking and suffocative cough, with cyanosis and blueness of the face; and the foreign body can probably be detected by introducing the *finger* into the pharynx. If unremoved, asphyxia will soon prove fatal. Low down in the Œsophagus a similar obstruction produces equal difficulty in the passage of anything swallowed, though not in the act of deglutition itself, and a sense of oppression with pain at the top of the sternum; but the degree of actual suffocation will depend on the pressure of the impacted body on the trachea. The substance can be detected by the introduction of an *oiled probang*, carefully guided down to the seat of obstruction.

Pointed bodies commonly lodge in some fold of mucous membrane behind the root of the tongue, between it and the epiglottis, or in the pharynx. Any substance so placed is felt by the individual, particularly in the act of swallowing; and it may, perhaps, be seen, by the *finger*. *Laryngoscopic* examination may be available for the detection of a foreign body situated high up in the Œsophagus.

SEQUENCES.—Rupture of the gullet has been produced, either by the force of impaction, or in consequence of ulceration with the formation of a mass in the cellular texture around the tube. Fatal hæmorrhage has ensued.

TREATMENT.—The foreign body impacted, must either be *extracted* or *pushed* into the stomach; but which of these two proceedings may be adopted will depend on the *situation* and *nature* of the substance.

In the *pharynx*, any kind of foreign body should be extracted, if possible. The patient being seated, with his head thrown back and mouth open, the Surgeon introduces his forefinger straight into the pharynx, feeling for the substance, hooks it up with his *finger*, or by a *hook*, and removes it with *curved forceps* guided by the finger. A pointed body, as a fish-bone or a pin, must be withdrawn very carefully, so as not to lacerate the pharynx. When any such body has been removed, a *sensation* will still be experienced by the patient for a while. A lump of substance, as a lump of meat, might be pushed down, through the Œsophagus, into the stomach, by means of a *sponge-headed probang* or an *expanding shaft*. (2.) Low down in the *Œsophagus*, an impacted foreign body may commonly be *pushed* into the stomach in like

maneuver, or perchance, by directing the patient to swallow a large mouthful of bread. But a rough substance, which would thus rupture the œsophagus, or one of a metallic or other kind unsuited to the stomach, as a half-crown, had better be drawn up gradually by the *hook-probang* or by *forceps*. Sometimes, an emetic will succeed in dislodging and ejecting the substance; or it has been dissolved, as in the case of a chicken-bone, by swallowing large quantities of dilute acid. This, however, is obviously an objectionable proceeding. The sensation as of a foreign body remaining for some time, after its removal, must not mislead the Surgeon—provided that the patient has a free passage in swallowing.

All other means having failed, *pharyngotomy* or *œsophagotomy* must be resorted to for the extraction of the impacted substance.

Stygonia may be so urgent that it will be absolutely necessary to perform *tracheotomy*, before attempting to remove the foreign body from the œsophagus.

Pharyngotomy and Œsophagotomy.—These operations consist in opening the gullet at one or other part; either for the removal of an impacted foreign body, or occasionally, in stricture, for the purpose of conveying food into the stomach.

The left side of the neck is usually selected; the œsophagus, inclining rather to this side, is there more accessible. An incision is made of sufficient length along the anterior border of the *sterno-mastoid muscle*, between it and the trachea. The skin, platysma, and cervical fascia having been divided, the dissection is carried directly backwards, avoiding the carotid sheath and larynx or trachea. The *omo-hyoid muscle* may be divided, but the *tyroid arteries* should, if possible, be avoided in this deep dissection. Having reached the pharynx or œsophagus, a *large sound or catheter*, had better be passed through the mouth into the cavity, and made to project as a guide on which to cut the opening into the gullet. Or the prominence of a foreign body may indicate the spot for incision. The aperture may then be enlarged either by dilatation with *forceps*, or by further incision with a blunt-pointed bistoury, to an extent sufficient for the extraction of the foreign substance, or for the introduction of a feeding-tube.

Use of the Stomach-Pump.—This apparatus is more often used for evacuating the stomach in cases of poisoning, than for the administration of liquid nutriment. A gag, with a hole in it, having been placed between the jaws of the patient's mouth, for the easy passage of a *flexible tube* without compression by the teeth, the tube is introduced through the gag, and passed cautiously down the back of the pharynx, thus avoiding the *vena cœliacalis*, and thence down the œsophagus into the stomach. For children, an elastic catheter of large size may be used. Having then attached the tube to the nozzle of the pump, or the catheter being connected by a piece of india-rubber tubing, the stomach is injected moderately full with warm water by working the pump, a pint or two being thrown in; then, reversing the action of the instrument, the water or admixture with the contents of the stomach is pumped up again. If the aperture in the tube become stopped up with undigested food, the action of the pump should be reversed sharply, to clear the passage; or, this failing, the tube must be withdrawn, washed out, and repassed into the stomach. Care must be observed not to withdraw the whole quantity of water injected,

mucous membrane of the stomach be sucked up into the apertures, as would happen if the stomach were empty. Water should be in and pumped out, until it returns *colourless* and the stomach completely *washed out*. Emetics are generally preferable to this natural mode of emptying the stomach, whenever vomiting can be assisted by freely swallowing diluents.

In the administration of liquid *food*, the stomach-pump may be used in like manner, only that the fluid is simply injected and not drawn out.

CHAPTER XLI.

DISEASES OF PHARYNX AND ŒSOPHAGUS; LARYNX AND TRACHEA.

—**Tonsils and Uvula.**—(1.) **Tonsillitis.**—*Acute* inflammation of the tonsils is denoted by *diffused redness* and *rapid swelling* of these organs, which may almost meet, leaving only a chink between them. Usually only one tonsil is affected. *Pain*, at first not acute, but rather dull, if the part had been bruised, is diffused over the back of the mouth and increased by any attempt at swallowing; tenderness also is felt in the throat of the neck and under the angle of the jaw. The saliva accumulates in the mouth and dribbles away, the patient holding his mouth slightly open to relieve the sense of strangulation, and speaking with a thick, creamy, foamy, or frothy secretion. The tongue is loaded with a creamy fur, and the breath fetid; there is a considerable throbbing headache, and rather sharp fever. The tonsils are readily seen on opening the mouth, by slightly depressing the tongue with the finger, or with a wooden pen-holder or pencil. The *cause* of acute tonsillitis seems to be *exposure to cold* in conjunction with some constitutionally disordered state of health, especially the dyscrasia. *Gout* and *rheumatism* have some influence in predisposing to tonsillitis, but the malady is essentially an affection of youth, the majority of the cases occurring from the age of puberty to the fifth year. On the other hand, tonsillitis is excessively rare after the first year. One tonsil recovers from the inflammation, the other often becomes affected.

The individual is sometimes subject to recurring tonsillitis, at intervals of a few months.

The inflammation *terminates* in resolution, or in adults not unfrequently in abscess; but suppuration is rare in childhood, apart from the foregoing.

TREATMENT.—In a majority of cases the internal administration of a purgative, given opportunely at the outset of the disease, cuts short the inflammation. It is useless, however, to exhibit that drug later than twenty-four hours after the commencement of the local symptoms, as its action cannot then be exerted. *Local* measures consist in hot fomentations or a mustard poultice from ear to ear, and sucking small pieces of ice. Any unfavourable *constitutional* state of the general health

from repeated inflammations, and hypertrophied masses more often occur in children of a scrofulous constitution with *scrophulous*. Hoarseness and painless, the enlargement usually other symptoms than those arising from the mechanical action of the hypertrophied tonsils. Hence some difficulty of *breathing*, the child snoring at night, and awaking in alarm is also met with, and there is more or less "throat-deafness" associated cases. Occasionally the hypertrophy attains a stage that the pharynx is almost occluded, and respiration is inefficient, and with considerable effort. As a result of this, after a time, contraction of the chest-walls sometimes take permanent diminution in the capacity of the thorax becomes. In some cases the tonsils are very much diseased, and the *tonsils* become decomposed, so that they communicate great breath, and doubtless also exercise a pernicious influence on health, by contaminating the air which passes over them during

Superficial ulceration sometimes supervenes from time acute inflammation frequently occurs. The abnormal mass becomes inspissated and hardened, so as to form veritable concretions.

TREATMENT.—Constitutional measures are of great importance. A general tonic plan of treatment, in the form of steel wine, preparations of iron, bark, cod-liver oil, and a nutritious diet, should be carried out. Sea-bathing is often most beneficial. Stimulating applications of nitrate of silver or iodine, though employed, can scarcely affect the condensed acolar or fibrous mass of the enlarged tonsils. In order to effect any good, a course strong to destroy to some depth the part to which it is applied. London paste (a combination of caustic soda and unguentum) is very efficient for reducing the hypertrophy. It is sold as a *paste* is moistened with a little water and rubbed up to a cream when about to be employed. It should be applied to small

of its bed, and a sufficient quantity removed with a *protected, blunt-pointed bistoury*, or the same partial excision can be performed by means of a *guillotine* or *tonsillotome*. In Physick's tonsillotome, the tonsil is encircled by a strong rim of metal, and a broad blade with a curved cutting edge is then pressed down against it with the thumb. In Fahnestock's instrument the excision is performed by a ring of steel sharpened on the internal circumference, which, when it encloses the tonsil, is drawn forwards towards the operator. Moreover, this guillotine is provided with two or three prongs, which transfix and steady the gland during the operation. Physick's tonsillotome can be used readily with one hand, whilst the other hand is applied under the angle of the jaw, so as to press the tonsil into the instrument. With the aid of two instruments, one for the right and the other for the left side, the removal of both tonsils is the work of a few seconds. The tonsil-guillotine is made in three sizes, as, unless it fits the tonsil with some accuracy, the gland is liable to be pushed on one side, instead of being cut through or transfixed, by the knife or prongs. I prefer the tonsillotome to the bistoury, especially for children, as it is a steadier mode of excision. This instrument can be used by the operator standing in front of the patient, for the excision of either tonsil; whereas, in removing the right tonsil with the bistoury and vulsellum, the operator must stand over the patient from behind, unless he be perfectly ambidextrous. Both tonsils may be operated on at the same sitting. A very efficient plan of arresting the *hæmorrhage*, if it be at all excessive, is to make some tannic and gallic acid (three parts of the former to one of the latter) into a thick paste with water, and to let the patient swallow about a teaspoonful of the mixture. In the act of deglutition the styptic is forced into the interstices of the cut surface of the tonsil, and the bleeding ceases at once.

(3.) **Elongation or Relaxation of the Uvula.**—Thickening, without elongation, of the uvula sometimes occurs; but an elongation or relaxation without thickening is the more common state. It appears to consist of an excess of mucous membrane, the azygos muscle not participating in the hypertrophy. The membrane may extend an inch beyond the extremity of the muscle, hanging down as a thin, narrow slip of this tissue, with a pointed extremity. When of this length, it touches the back of the tongue or even the epiglottis. Constant irritation occasions a *spasmodic cough*, while the tickling sensation may excite nausea or even *vomiting*. The patient's life is sometimes thus rendered quite miserable.

The CAUSE of this hypertrophy generally seems to be chronic catarrh, or an habitual over-exertion of the voice. Hence it is not uncommon among clergymen and public speakers. The affection often occurs in persons of a gouty diathesis.

TREATMENT.—Astringents topically applied have some beneficial influence. Tonic treatment of the general health is an important adjunct, but the apparent causes adverted to must, of course, be removed when circumstances permit. Should relaxation still continue in spite of all remedial measures, a portion of the pendent uvula must be *cut off*. This may easily be done by seizing the extremity with polypus-forceps, and snipping off, with blunt-pointed scissors, so much as to leave the stump of the natural length of the uvula. A combination of forceps and scissors—an instrument of American invention—has been used for this purpose,—the uvula being held and cut off at the same time.

Post-Pharyngeal Abscess occasionally forms in the cellular texture behind the pharynx, as an idiopathic disease in children; more rarely it results from caries of the cervical vertebræ, or from the impaction of a foreign body.

The **SYMPTOMS** are *difficulty of deglutition*, and perhaps *dyspnoea*, owing to pressure on the larynx; or nasal intonation, if the posterior nares be occluded. On examining the interior of the pharynx, a *tense, fluctuating swelling* may be seen and felt. This must not be mistaken for a polypoid or other solid growth of the walls or cavity of the pharynx. Pharyngeal abscess may burst into the mouth, or extend downwards under the sterno-mastoid muscles and present in front of the neck.

The **TREATMENT** consists in evacuation of the matter by a well-timed puncture with a sharp-pointed, protected bistoury at the most dependent part of the abscess. The pus discharged has an offensive smell, not unlike that of a rectal abscess.

Stricture of the Œsophagus.—This condition may be the result of certain distinct diseases of the œsophagus, producing a contracted state of its tube, which is commonly designated *organic* or *permanent stricture* to distinguish it from *spasmodic stricture* of the œsophagus.

1. **ORGANIC stricture** may be of *traumatic* origin—a *cicatrix* resulting from ulceration produced by the impaction of a foreign body, or it may be occasioned by swallowing some acrid poison, as sulphuric acid. The latter mode of origin gives rise to a valvular *fold* of the mucous membrane, like an intestinal stricture consequent on dysentery. *Cancerous* thickening of the œsophagus may be *epithelial*, *medullary*, or *scirrhus*. Malignant disease of the œsophagus almost invariably occurs in one of three positions; viz., most frequently opposite the cricoid cartilage; next, near the œsophageal orifice of the stomach; and, lastly, opposite the bifurcation of the trachea.

SYMPTOMS.—At first, slight *dysphagia* is experienced in the passage of solid food to the stomach. This increasing, the patient restricts himself to *fluid food*. At length, fluids are sipped only a few drops at a time, and perhaps partially rejected. Constant hunger tortures the patient day and night, yielding, however, at last to loss of desire for food; rapid emaciation and declining strength ensue. An almost never-failing symptom is the *expectoration* of a *clairy fluid*, a combination of saliva and mucus, which is *continually* passes down the gullet, but in cases of obstruction collects above the seat of stricture, and requires to be ejected from time to time. If ulceration takes place, expectoration of a semi-purulent and offensive secretion denotes this change, the breath also becoming perceptibly foul.

Swanwick's method of *œsophageal succulation* affords valuable evidence in all cases of obstruction, but this mode of examination requires much *skill* and *constant practice*. The cautious introduction of an *œsophageal bougie* will denote the existence of a stricture, for the instrument comes to an obstruction or passes with difficulty. Before passing the bougie, care should always be taken to ascertain that no thoracic disease obstructs the passage. The kind of stricture must then be determined. *Spasmodic* stricture presents a limited and smooth extent of obstruction; as soon as blood follows the withdrawal of the instrument,

but simply mucous discharge; there is no tumour in the neck, no cancerous enlargement of the cervical glands, nor cachexia. *Epithelial or encephaloid* stricture differs or contrasts in all these particulars: a larger and irregular surface of contraction, through which the bougie passes roughly; pus and blood, or the latter more especially, with shreds of tissue, follow the withdrawal of the instrument; while in some cases an elongated tumour is to be felt at the root of the neck, with enlargement of the cervical glands, and there is often cancerous cachexia.

2. *SPASMODIC* stricture is distinguished by the *intermittent* character of the contraction; it being sometimes present, sometimes absent, and situated more often in the pharynx than the Œsophagus. The dysphagia *intermits*, and seems to be influenced mainly by the patient's attention being directed to or diverted from the complaint; the other symptoms—*hunger*, emaciation, and loss of strength—are far less pronounced, and, indeed, are often altogether absent. The disease occurs most frequently in *hysterical* females. The introduction of a bougie is at first resisted, but the stricture soon yields under gentle pressure. A pathognomonic symptom is the *sudden ejection* of the bolus during the act of swallowing; the morsel passes down for a certain distance without stoppage, and is then forcibly expelled from the mouth with a sudden jerk.

Dysphagia may be *unconnected* with stricture, but dependent on some extrinsic cause or causes which diminish the calibre of the gullet by compression or obstruction. Such are—tumours connected with the pharynx; morbid conditions of the larynx, *e.g.* œdema; tumours in the neck; aneurism of the aorta or of the innominate artery; intra-thoracic tumours; dislocation of the external end of the clavicle backwards; impaction of a foreign body in the gullet. It is to be noted that great difficulty of swallowing may sometimes be caused by a comparatively small goitre, if the enlargement is deeply situated, when the swelling presses on the *sides* of the Œsophagus. The *diagnostic* differences of these various conditions may be gathered from other sections of this work.

TREATMENT.—1. *Organic* stricture, of whatever kind, is incurable. *Dilatation*, by means of bougies increasing in size, may afford partial and temporary relief. But the risk of perforating the Œsophagus should be remembered, a risk proportionate to the structural disorganization and contraction of the passage. The instrument has been known to find its way into the mediastinum, into the cavity of the pleura, or into that of the pericardium. The principal use of a bougie is to determine the existence of a stricture, its situation and nature, and thus to complete the diagnosis of this affection—due caution being observed in passing the instrument.

Nutritive enemata will tend to support the strength and prolong life; while washing out the mouth with whatever fluid is most relished, and swallowing perhaps a little of it from time to time, proves an agreeable occupation to the patient. In *cancerous* stricture, laudanum or other anodynes, administered in the enemata, will assuage the sufferings of this condition. Very good results have in recent years been obtained by *permanent catheterization* of the Œsophagus, as proposed by the late Dr. Krishaber, of Paris. The tube is left *in situ* (except when removed at proper intervals for cleaning), and the patient is fed through it.

2. *Spasmodic* stricture is sometimes amenable to the general consti-

tional treatment of hysteria. At the Hospital for Diseases of the Throat, water-cure of this is largely employed in these cases. The most effective agent, however, is galvanism, applied directly to the interior of the gullet by means of Mackenzie's œsophageal electrode. The constant current must be employed, by the aid of a battery containing about twenty cells. The electrode should be passed down as far as the seat of apparent stricture, and held in position for a few seconds. At first only five cells should be used, but the number may be increased gradually up to twenty, and the time during which the electrode is held in the œsophagus may also be augmented, according as the patient becomes more tolerant of the remedy.

GASTROSTOMY, or the operation of opening the stomach by an incision through the abdominal wall, has been performed, for the purpose of directly introducing food into the organ, when the œsophagus is impassable. Having regard to the object of this operation,—the formation of an artificial mouth in the stomach, it is sometimes, and more correctly, named **GASTROSTOMY**. Whilst giving decided relief in cancerous cases, it may prolong life indefinitely in traumatic stricture, particularly if done at a sufficiently early period before the patient has lost strength through prolonged deficiency of nourishment. The following is the best way of performing gastrostomy:—The patient lying on his back, the Surgeon, standing on the right side, makes an incision two or three inches in length, on the left side of the mesial line of the abdomen, parallel to the inner side of the costal cartilages, and about one finger's breadth from their margins—having previously satisfied himself by percussion and palpation that the liver is not in his way. The dissection is carried through the abdominal wall, and the peritoneum opened. Then, feeling with his left index-finger for the left border of the liver, and following this upwards, the stomach is reached. The organ is seized with forceps, drawn forward, and its structure recognised. The anterior wall of the viscus is then fixed to the edges of the integumental aperture, by three or four points of suture, or by a double circle of sutures, as recommended by Mr. Howse, to insure firm support for the stomach by forming a large area of adhesion to the abdominal wall. The actual opening into the stomach should, in accordance with the best modern practice, be delayed, whenever possible, for some days, till the wall of the stomach has become securely united to the parietal peritoneum. The *second stage* of the operation, which is the establishment of the gastric orifice, may be accomplished by making a puncture in the middle of the exposed portion of the stomach-wall with a small knife. The opening, which should at first be only large enough to admit a fine catheter, should be gradually dilated as much as may seem desirable. The wound may be dressed with a thickish pad of lint steeped in carbolized oil (1 in 60), which is kept in place by means of a body-bandage. Food is introduced through a silver tube passed into the fistula, and much depends on the *manner* in which it is administered, which should be based on the natural physiological mode of eating, *i.e.* small spoonfuls should be given with a proper interval between them. When the stomach has become habituated to the novel conditions under which it receives nourishment, the patient may advantageously masticate his food in the usual way, and then make it pass into his stomach through an elastic tube connecting his mouth with the fistulous aperture.

AGOSTOMY,* or opening the gullet below the point of stricture, once a few times in recent years, but hitherto without a sufficient success to justify its acceptance among the established operations.

The œsophageal stricture is at the lower end of the tube, "RETRO-ULSION" has lately been recommended by Loretta. The operation consists in opening the stomach and dilating the stricture from below. It has been claimed to have obtained good results in the few cases in which the patient has had the opportunity of putting this procedure in practice.

x and Trachea.—(1.) **Laryngitis.**—Inflammation of the larynx attended with more or less *dyspnœa* and *aphonia*, and generally attended with difficulty of deglutition, the severity of the symptoms being proportional to the effusion and swelling. Ordinary ACUTE laryngitis principally affects the mucous membrane of the larynx—the *œdematous* variety attacks the submucous cellular tissue.

Chronic laryngitis, resulting in thickening of the mucous membrane of the larynx, is attended, more particularly, with *aphonia* or various modifications of the voice—such as *hoarseness*, squeaking or broken voice, and frequent spasmodic cough. This form of the disease is commonly met with among clergymen, vocalists, public singers, and others, who are accustomed to use their voice to excess—often when catarrh exists.

CONSEQUENCES.—The usual consequences of inflammation may follow, such as abscess, sloughing and ulceration of the mucous membrane, and occasionally caries, etc., may supervene.

Spasm of the Glottis gives rise to great *dyspnœa*; and, if not relieved, death will often ensue. The affection is common in *children* of rachitic diathesis, and is known as *laryngismus stridulus*, pseudo-croup, or spasmodic croup. It is due to reflex action, such as teething or intestinal disease. In *adults*, it may occur in connection with laryngitis, or it may be due to irritation of, or pressure on, the laryngeal nerves by an aneurism or tumour. In *females* of a hysterical disposition spasm of the larynx is also met with.

Tracheotomy and Tracheostomy.—The windpipe may be opened by tracheotomy; either to establish Artificial Respiration for a time, or to remove a foreign body. According to the situation of making the incision, the operation is designated: Laryngotomy, when the laryngeal membrane is thus opened; Tracheotomy, when the trachea is opened.

Various conditions of injury or disease which cause a mechanical obstruction to the respiration, and which may require either of these operations for relief, have been noticed in other parts of this work.

Tracheotomy is very readily performed. The head of the patient is turned back, the depression between the thyroid and cricoid cartilages is carefully touched with the point of the finger. A *vertical incision*, about an inch long, is made in the *middle line*, with a narrow-bladed, straight razor or scalpel; this incision passing between the sterno-thyroid and crico-thyroid membrane at once enters the trachea.

The air rushing in and out of the aperture, and the improvement of the respiration, shows that the object of the operation has been accomplished. It must not be confounded with *œsophagotomy*, or incision through the wall of the œsophagus for the removal of an impacted foreign body.

is accomplished. A curved laryngotomy-tube of suitable size should be introduced and retained by tapes fastened round the neck. Very little hæmorrhage occurs, but a small branch from the superior thyroid artery, running across the membrane, may be divided and require torsion or ligation.

TRACHEOTOMY.—This operation consists in cutting down upon the trachea, in some part of its extent, and then dividing two or three of its cartilaginous rings; a more difficult and perhaps dangerous proceeding than laryngotomy, particularly if the neck be short and fat, the veins large, and the trachea deep, small, and restless,—moving up and down

with each effort of hurried and forcible respiration. All these adverse conditions attend the operation in *children*.

The head being thrown straight back, an incision is made exactly in the middle line of the trachea, about an inch and a half to two inches long, extending from the lower margin of the cricoid cartilage downwards nearly to the top of the sternum (Fig. 97). The skin, superficial fascia, and fat are thus divided; the opposed margins of the sterno-hyoid and sterno-thyroid muscles are then separated with the scalpel, and the veins in front of the trachea drawn out of the way to either side; any unusual artery, discovered by its pulsation under the finger, is also avoided. The *isthmus*, or connecting central portion of the thyroid gland, may have to be drawn upwards; but, if wounded, the hæmorrhage is very troublesome. In *children*, the remnants of the thymus gland and vessels lie immediately over the trachea; the thin, flattened lobes should be separated, and, with their vessels, drawn to either side. A tenaculum is dipped into the upper part of the trachea, which is thus drawn upwards and steadied on the stretch; then, taking advantage of a favourable moment of exposure, the Surgeon pushes the knife, with a slight jerk, into the lowest portion of the trachea, and, carrying a small incision upwards, divides two or three of the cartilaginous rings of this tube. Occasionally, the rings being in an ossified state, they must be divided with a pair of strong scissors. The air rushing in and out again shows that the windpipe is opened, but special care should be taken to prevent any oozing of blood, arterial or venous, into the trachea. A curved tube of a conical shape, flattened laterally, or Ducham's rectangular tube, should be introduced into the tracheal aperture. The latter form of tube allows of any movement of the trachea, without friction against the anterior wall of the windpipe, and is not liable to be tilted out in fits of coughing. The cannula should be of sufficient size to completely fill the tracheal incision, and allow of free

FIG. 97.



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tion, "without," as Trousseau remarks, "any whistling noise." In case of *croup*, the tube should not be introduced until any false membrane that is present has been expelled or extracted. A *double tube* is preferable to a single one, especially if there be much expectoration; the inner tube can be taken out and cleansed. The tube is secured by tapes round the neck (Fig. 98). When the patient wishes to cough, he should be instructed to close the orifice of the tube with his finger.

FIG. 98.



AFTER-TREATMENT must have regard to the free passage of air through the tube, and of air duly warmed, and moistened—now that the breath is drawn more freely into the lungs, instead of passing through the nose or mouth to the larynx. A bedstead of blankets may be easily raised, and a tube connected with a boiler will supply steam to *moisten* the air where in which the patient breathes. If such an arrangement cannot be made, a bowl of moderately saturated with warm water should be placed close to, not over, the trachea-tube, under a canopy of oiled silk, to answer the purpose. The tube may be freed of any obstruction by removing mucus collected there, with a feather from time to time. Or, if the *double tube* be used, the inner one can be readily withdrawn, as occasion requires, and having been well cleansed with warm water, is easily reinserted. The final removal of the tube is determined by the establishment of natural laryngeal respiration. When the tube is withdrawn, the wound heals more or less readily. In *chronic* laryngeal disease, or if there be a liability to the recurrence of the trouble, it will often be necessary to retain the tube for an indefinite length of time. A *double tube*, provided with a *pea-valve*, should then be worn. The patient is thus enabled to breathe through the tube, and to expire—and thus speak—through the trachea. At night the valve should be dispensed with. From wearing the tube some irritation and expectoration are not unfrequently induced; but a *double india-rubber tube* answers admirably for constant wear, without causing much irritation of the tracheal mucous membrane. A thickened, most cheloid growth around the opening in the neck is the only result.

The removal of any *foreign body* from the larynx or trachea must of course be effected before passing in the tube, in either of these operations, and taken for this purpose. The exact situation of any such substance has been ascertained by passing a probe through the artificial opening in the trachea; forceps of suitable size and shape are then cautiously inserted and the body extracted.

CHAPTER XLII.

DISEASES OF THE THYROID GLAND. THE PAROTID GLAND. TUMOURS OF THE NECK.

Thyroid Gland.—Bronchocele or Goitre.—This condition is an enlargement of the thyroid body, existing in one of three forms: as *hypertrophy* of the proper structure of the thyroid, or **SIMPLE** bronchocele; cysts imbedded in the substance of the gland, containing a glairy or bloody fluid, and perhaps becoming proliferous by growths springing from their interior, forming **CYSTIC** bronchocele; or as an enlargement of the thyroid vessels in and around the gland, constituting a vascular swelling, or **PULSATILE** bronchocele, and as being associated with an unnatural prominence or protrusion of the eyeballs and an anæmic condition, this form of disease is sometimes known as **EXOPHTHALMIC** bronchocele. *Combinations* of these three conditions of bronchocele are not unfrequently met with; cysts associated with hypertrophy, or vascular enlargement with cysts. *Modifications* also may be produced by morbid changes; extravasations of blood, and its alterations, resulting in pigmentation; or fatty and calcareous degenerations taking place.

SYMPTOMS AND DIAGNOSIS.—Certain appearances and phenomena are common to all three forms of the disease. A *swelling*, corresponding in situation and shape to the thyroid gland, is presented in front of the neck; and which has a soft elastic character. Usually, both lobes of the gland are affected, and the tumour is bilobular; rarely, however, equally so; the right lobe is commonly the larger; occasionally, the middle lobe or isthmus is principally affected. The tumour always *follows* the movements of the trachea, to which it is attached, and of the œsophagus as connected therewith; the swelling therefore rises upwards towards the chin when the patient is directed to swallow, and then lowers again to its original position as the act of swallowing ceases. This rising and falling of a tumour in the neck during deglutition is *diagnostic* of bronchocele from any other tumour, not implicating the thyroid gland, or directly attached to the trachea. The skin over the tumour is not discoloured, or in an otherwise unhealthy state.

The *mechanical* results of pressure on surrounding parts are proportionate to the size of the tumour. Difficulty of breathing, especially in a stooping posture, and of swallowing, or *dyspnoea* and *dysphagia*, with some congestion of the brain, arise from pressure on the trachea, œsophagus, and jugular veins; hacking cough also ensues from a diseased condition of the trachea itself. Spasm of the *glottis*, from irritation of the recurrent laryngeal nerve, may give rise to similar and more urgent symptoms.

Cystic bronchocele is distinguished from simple hypertrophy of the thyroid, or ordinary bronchocele, by *tension* and *fluctuation* in the cystic portions of the enlarged gland, and by a somewhat specially *lobulated* character, where the cysts partially project.

Pulsating bronchocele is thus distinguished from ordinary goitre:—The size of the tumour varies considerably with the general condition of the patient as to rest or excitement, and their effect on the heart's action;

the tumour rarely becomes large enough to produce any great deformity; and the *purring thrill* and *loud murmur* in the tumour, with *jerking* of the *carotids*, and the general symptoms—*palpitation* of the heart and *prominent eyeballs*—will complete the diagnosis.

CAUSES.—Common bronchocele, hypertrophy of the thyroid gland, occurs mostly in *women*, and commences about the age of puberty in this country. It may, however, be congenital, but not enlarge until puberty. It is frequently associated with some derangement of the menstrual function, and with an anæmic state of the general health. Hence the females affected have a pallid, weak, miserable appearance. Pregnancy alone not unfrequently induces enlargement of the thyroid gland. *Endemic* influence is remarkable; the disease prevails in Derbyshire, Nottingham, and the alkali parts of England; in the valleys of the Alps, Apennines, and Pyrenees. In Savoy, Switzerland, the Tyrol, and Carinthia, there are localities in which all the inhabitants, without exception, have these swellings. The disease arises in low, damp situations chiefly, and under hygienic circumstances favourable to anæmia and debility; it is often associated with cretinism and idiocy; seeming to have an hereditary character in imperfect physical and mental development. Billroth affirms that goitre is more common in persons with well-developed bones and brains.

Pulsating bronchocele is said to be independent of endemic influence, its form of the disease would appear to have a *neurotic* origin, in some cases, according to Professor Agnew's observations. In three instances, ophthalmic goitre was developed from mental causes.

Injury to the neck has sometimes been noticed as an exciting cause of bronchocele, a twist or strain of the neck having, apparently, given rise to the disease.

TREATMENT.—The *hygienic* conditions productive of the disease must, if possible, be changed; the patient being removed from a low, damp situation to a more airy locality. *Medicinal* treatment should have reference principally to the constitutional condition—anæmia. Iron, particularly the sulphate, may be administered with marked benefit; also quinine, and especially iodine. The iodide of potassium is now commonly prescribed. Topically also, iodine ointment, or that of the iodide of lead, may be rubbed into the tumour with advantage; or the emulsion of ammoniacum cum hydrargyro can be applied. Dr. Mouat speaks highly of the biniodide of mercury ointment—sixteen grains to the ounce; inunction continued for several days, being aided by exposure to the sun; a mode of treatment which has proved very successful in India. But generally all local applications are comparatively useless.

Ligature of the thyroid arteries, as the nutrient vessels, has been had recourse to. The difficulty and danger of this operative proceeding, its questionable results, and the probability of other arterial branches becoming enlarged, constitute serious objections thereto.

Pulsating bronchocele would be most appropriately treated by *ligature*. Injection of perchloride of iron has been found serviceable, subject to the risk of considerable inflammation, suppuration, and pyæmia supervening.

Cystic bronchocele may be tapped here and there, and injected with a solution of iodine, in order to induce inflammation and adhesive obliteration of the cysts.

should be accomplished with similar precaution; and the gland secured on either side by *double ligature*, previous to intervening portion. Successful results have followed the complete excision, in a few cases.

Tracheotomy may be performed for the relief of stridor arising either from direct pressure on the trachea, or spasmodic due to irritation of the recurrent laryngeal nerve.

Parotid Gland.—Tumours.—(1.) **GLANDULAR PAROTID** is the most frequent tumour in connection with the parotid gland, usually developed in one of the lymphatic glands lying over perhaps in the fibrous envelope of the gland itself. It is an adenoid or glandular tumours connected with the mammary glands, and is described by Bauchet as an hypertrophy of the gland, consisting of fibrous tissue mixed with glandular elements, in portions of cartilage, and one or more cysts. A distinct capsule encloses and isolates the tumour.

SYMPTOMS.—This parotid tumour appears as a *firm hard* swelling generally below and behind the lobe of the ear, but sometimes *Growing slowly*, and displacing the parotid and the parts covered by it. When the tumour becomes *buried deeply* behind the ramus of the mandible, deformity thence arising, hearing and mastication are interfered with, and perichance facial paralysis may occur on the affected side.

TREATMENT.—*Removal* of the tumour with a knife is the best method, the operation is both difficult and dangerous. A *T-incision* is the most convenient; the vertical line passing down the posterior border of the tumour, where it is most safely approached. It has been removed a second and a third time, as in a case recorded by Langenbeck, at the end of a year, and again after five years the tumour was extirpated.

(2.) The parotid region is subject to other tumours, which are not at all peculiar to this part of the body. Thus we recognize **CELLULAR, FATTY, CYSTIC, CARTILAGINOUS, and CANCEROUS** growths incident to the parotid region.

The *removal* of any such tumour must be determined by the nature of the growth.

Tumours of the Neck.—(1.) ENLARGEMENT OF THE CERVICAL GLANDS, in *scrofulous* persons, is a common affection; appearing in the form of round, puffy or indurated, submaxillary lumps; indolent or suppurating. A chain of rather large, rounded tumours, along the anterior margin of the trapezius, on both sides of the neck, is said by Miller to be characteristic of *syphilis*; and these lumps, though indurated, never suppurate. They are sometimes the first, and the last to go, of any constitutional symptoms. Glandular enlargements of stony hardness, and involving the whole lymphatic chain, may be conjoined with *exophthalmic goitre*, as a result of the anæmic condition. Such enlargement resembles scirrhus in action, but has a totally distinct origin.

Treatment will depend on the causative condition.

(2.) INDURATION OF THE STERNO-MASTOID MUSCLE is not uncommon in children. It may be distinguished from any enlargement of the cervical glands, which lie posterior to the muscle, by two circumstances: in the one case, the swelling is within the sterno-mastoid, and its mobility varies with the contracted and relaxed state of the muscle; in the other case, the swelling is behind the muscle and is unaffected by its action.

Treatment.—This muscular affection is very curable in childhood, by counter-irritant and tonic measures; while glandular enlargements are intractable and may be quite incurable.

(3.) ENLARGED BURSÆ are found in the anterior part of the neck, though rarely. These bursal tumours may be situated in front of the Adam's apple, or between the posterior surface of the hyoid bone and the thyroid cartilage, or between the muscles of the tongue. The tumours rise and fall in the movements of deglutition, thus resembling cystic bronchocysts; but their situation is partly distinctive, and puncture will determine the diagnosis, by the nature of the contained fluid.

Treatment consists in blisters, puncture, and injection of iodine.

(4.) CYSTS singly, or aggregated and forming a multilocular tumour, known as *hydrocele* of the neck,—may occur in either triangle of the neck, commonly the posterior triangle, or beneath the sterno-mastoid muscle. Each cyst or cysts may be situated superficially, usually more deeply; and sometimes become so numerous as to occupy the whole side of the neck. The contents of the cysts are various; serous or sanguineous fluid of a brownish colour, or sebaceous matter. (Langenbeck.)

The characters of the tumour thus produced are always similar; a soft and elastic, round, or somewhat lobulated swelling; varying in position, prominence, and size. Deglutition and respiration may be more or less impeded. The diagnosis from *abscess* will be determined by puncture. *Hydatid* cysts, which have also been met with, yield the remains of echinococci.

Treatment.—Tapping and injection with iodine. Suppurative action induced by means of a seton may be equally curative, but it is more hazardous. Irrigation will scarcely ever be advisable, owing to the situation of these cysts. They are readily detached,—being loosely connected; but to an indefinite extent, may render their complete removal impracticable. Possibly also some large vein may be opened, with the fatal admission of blood into the circulation.

(5.) CONGENITAL tumours—usually of a cystic character, and multilocular—are met with in the neck occasionally. They may be partly solid.

neous cure which is sometimes effected when the cyst bursts its contents.

Congenital Fistulæ in the neck may be here noticed, condition. They present one or more minute orifices, at the neck—more often on the right side, sometimes on both sides. Generally communicating with the trachea, or perhaps with these fistulous channels vary in position, from the upper thyroid cartilage down to near the sterno-clavicular articulation. When existing on both sides, they are arranged at the same congenital condition appears to be the result of an incomplete three fissures in the neck of the human embryo, and which other warm-blooded animals at an early period of fetal life; corresponding to the branchiæ of fishes, and coinciding in the appearance with a vascular arrangement similar to that in fish. Naturally, any such malformation is more curious than important; it behoves the Surgeon to rightly understand the nature of the neck or ears.

CHAPTER XLIII.

INJURIES AND DISEASES OF THE SPINE.

THE various kinds of injury and diseases, including malformations of the Spine is liable, may be conveniently arranged in order: (1) Fracture and Dislocation; (2) Concussion; (3) Comminution; (4) Caries; (5) Lateral Curvature; (6) Spina Bifida.

Fractures of the Spine.—The several parts of a vertebra are liable to fracture. The processes, articular, transverse, and spinous,

tion often accompanies spinal fracture; and dislocation of the processes in the back and loins cannot, perhaps, take place. In the neck, these two forms of injury may occur. This difference is owing to the different direction of these in the three regions of the spine; in the cervical region having for almost a horizontal direction; while in the dorsal and lumbar they are vertical.

The *spinal cord* and its membranes suffer *compression* or *laceration* in the displacement of the bodies of the vertebrae; but the membrane is comparatively rarely ruptured or torn, although the cord has been completely divided in some cases. When the fracture is limited to the process, or even the arch of the vertebra, the spinal cord may escape.

The *hæmorrhage* in the substance of the cord is inconsiderable; the vessels which permeate the cord being minute and soon ceasing to contain *venous blood*, from the large sinuses in the vertebral canal, and perhaps considerable quantity between the vertebrae and the cord; and particularly under the arches of the vertebrae, where the attachment of this membrane is loosest. Any such extravasation of blood is an additional source of pressure on the cord.

Symptoms.—The symptoms of spinal fracture are both general and particular, pertaining to the particular region which may be the seat of

The *general symptoms* are, locally, some *alteration of contour* in the spinous processes, depending on and proportionate to the displacement.

The processes above the seat of fracture are depressed, and the spinous process is more prominently prominent below. The transverse processes also may be depressed, and the spine twisted on itself. *Rarely* can any *crepitation* be felt, unless the fracture be limited to one or two processes. But more or less swelling and discolouration are present. Pain is experienced at the seat of injury, and there is notable inability to support the trunk erect. The general symptoms otherwise vary of the *spinal cord*,—as also depending on the displacement. *Paralysis* of sensation and voluntary motion *below* the seat of fracture; constipation, with involuntary evacuation of the *fæces*, which are thickish, pultaceous, and have an offensive odour; and *retention of urine* which becomes ammoniacal, and is voided by a dribbling issue. Priapism and emission of the semen may occur as occasional

The fracture in the upper part of the *lumbar* region produces—in addition to the general symptoms—a tympanitic condition of the abdomen; the intestines being almost suddenly distended with gas. In the upper part of the thoracic region, the thoracic respiration is embarrassed or suppressed, by compression of the cord above the origins of the intercostal nerves. At the *first* cervical vertebra fracture is attended with paralysis of the upper extremities; and above the *third* cervical vertebra, compression of the cord is instantly fatal by asphyxia—the phrenic nerves thus being

External violence applied *directly*, or *indirectly*, to the vertebral column, represents the two modes of fracture-production. A blow on the back is one mode of fracture; a fall on the top of the

head, or compression of the trunk vertically, as between the box of a carriage and an archway, is the other, or indirect mode of producing fracture of the spine. *Gunshot* injury, as a cause of fracture, may be complicated by the lodgment of a foreign body, as a ball or portion of clothing.

TREATMENT.—The fracture itself cannot be treated. No displacement of consequence can well or safely be rectified; and no mechanical appliances can be applied effectually. Any injury to the spinal cord must be treated with reference to *inflammation*. The patient being placed in bed, flat on his back, to insure rest; local depletion by leeches may first be employed, followed by counter-irritation, cautiously, having regard to the tendency to bed-sores. *Subsequently*, the administration of strychnine in small and increasing doses, continued until slight tetanic twitchings are produced, will have the most beneficial influence on the paralysis. Electricity also may be employed, perhaps with advantage.

The *state of the bladder* will require the constant introduction of a catheter to relieve retention; while the treatment appropriate for chronic cystitis may have some avail in changing the character of the urine. The *bowels* must be carefully regulated by laxative aperients, such as castor oil, and enemata occasionally of turpentine and gruel.

Bed-sores are produced by ulceration of a gangrenous character, as the consequence of prolonged pressure on prominent parts of the body, during any long and exhausting confinement to bed.

The formation of bed-sores is provoked by irritation or maceration of the integument, by perspiration, urine, or feculent matter having saturated the bed, from want of cleanliness; but there is always a special predisposition to such ulceration in enfeebled and aged persons; while the influence of paralysis and of certain blood-diseases is witnessed in the frequency of bed-sores after injury to the spine, and in the course of pyæmia or septicæmia, typhus, or other fevers. *Prevention* is nearly always possible. The patient should be thoroughly examined from time to time, to see that no bed-sore is threatening. Exposed parts—the sacrum in particular—may be fortified by washing them with some *slightly stimulant lotion*: such as spirits of wine, or with the addition of two grains of bichloride of mercury to the ounce, or a weak carbolic-acid solution; or, the part may be *mechanically protected* with a layer of soap-plaster spread on thick wash-leather, or with a pad of cotton-wadding. A proper adjustment of ring-cushions or air-pillows will further aid in removing pressure; and the water-bed is often a most useful resource. Any abrasion of the skin may be painted over with collodion; when sloughing takes place, separation of the dead textures should be promoted by poulticing with charcoal or carbolized charcoal; and, afterwards, the clean ulcer may be dressed with a weak stimulant solution, as of perchloride of iron or tincture of myrrh. Care must still be taken to guard against pressure. Throughout the treatment, whether preventive or remedial, the patient's weak circulation and low nutrition must be invigorated, as far as possible, by tonics and nutritious food.

Concussion of the Spinal Cord.—This expression is used to denote a shock, shake, or jar of the spinal cord, as the immediate effect of violence, directly or indirectly applied to the Spine. This is attended with or followed by an impairment or loss of the functions depending on the integrity of the cord—symptoms of a paralytic character.

SYMPTOMS.—(a.) *Direct and severe* concussion is attended with *immediate* and marked symptoms. *Pain* at the seat of injury is felt, with *loss of power* in the extremities below that part, and there may be *relaxation* of the sphincters, the *fæces* and *urine* perhaps escaping *incontinently*; and all these symptoms are accompanied with those of *general shock* to the nervous system. The symptoms may pass off in the course of a few days, or result in complete *paraplegia*, of some months' duration and permanently irrecoverable.

(b.) *Direct but slight* concussion is followed by similar spinal symptoms, which *developed slowly and insidiously*, in the course of several weeks or months; but the causative relation between that comparatively slight injury and the apparently independent and serious symptoms subsequently, may be *improbable* to the patient and to those who are unacquainted with such cases, and may be overlooked by the Surgeon.

(c.) *Indirect concussion*, from a *general Shock to the nervous system* or the whole body.—Railway collision usually causes this mode of concussion; the carriage being brought suddenly to a stop, the traveller's body is carried forward by its own momentum, and dashed forwards against the opposite side of the carriage, thence perhaps to rebound back. Or, without any contact from collision, the body may receive the shock, and the trunk be thrown backwards and forwards with a *considerable* concussion, in this way also wrenching and twisting the spine to and fro, the nature of a sprain. A fall or jump from a height, the individual falling on his feet or his nates, may have a similar effect; general concussion involving the cord, and spinal sprain.

The symptoms arising from this mode of concussion are often *slow and insidious* in their progress, weeks or months elapsing ere they assume a decided intensity. They relate to the brain, the spinal cord, and the system—as affected by chronic cerebro-spinal meningitis, and spinal myelitis.

TREATMENT.—*Rest*, absolute rest, is essential to any probability of recovery from spinal concussion or wrench. The patient should keep the recumbent position, or a prone couch may be used, until the paralytic symptoms have disappeared; and especially until the limbs have regained power of voluntary motion, and sensibility. A prone couch offers the advantages of preventing venous congestion of the spine, as the result of continued recumbency; any tendency to sloughing from pressure over sacrum and nates, the liability to which is always greater in paraplegia, also be prevented; and the prone position readily allows of any local treatment. Rest of the brain is equally essential to recovery; freedom from the excitement of business or pleasure, which, although apparently beneficial for a time, is permanently conducive to a fatal issue. *Local treatment* consists in derivation from the spinal cord, by means of dry-cupping along the spine on either side; followed by counter-irritation, by blisters, setons, issues, or even by the actual cautery, in the form of the *cauterium*. *Constitutional treatment* comprises the continued administration of gentle mercurials, especially the bichloride, or iodide of potassium, with quinine, as a tonic. *Subsequently*, when all inflammatory action has subsided, and paralysis of motion, sensation, or both, alone remains, with a hectic state of the health, strychnine and iron will prove efficacious. A twentieth or twelfth of a grain of strychnine, with three or four grains of the sulphate or phosphate of iron, in the form of a pill, three times a

day, may be continued with advantage until slight tetanic twitchings are induced. In conjunction with strychnine, the galvanic current should be employed; one pole of the battery being placed in the course of the spine, while the other is applied up and down the paralytic limbs, so as to excite the action of different sets of muscles. Salt-water douches, and frictions, may also have some beneficial influence. The general health and strength must be supported and renovated by a nourishing diet, and other hygienic measures. I have seen the best remedial results from this course of treatment, in many cases.

Compression of the Spinal Cord.—This injury to the cord may depend on either of three causes, or perhaps their concurrent action: *intra-vertebral hæmorrhage*; *intra-vertebral suppuration* or abscess; and *fracture* of the spine, with *displacement*. The two former causes of compression must severally be treated on general principles; the latter is noticed under *Fracture of the Spine*. Sometimes, compression may be referable to an *intra-vertebral tumour*; as a gummatous growth, in the course of *sypilis*.

Disease of the Spine.—The generic term, disease of the spine, is ordinarily understood, signifies *caries* of the vertebræ, apparently of a

FIG. 99.*



FIG. 100.*



scrofulous character; which commences probably in the *bodies* of these bones, and involves the inter-vertebral fibro-cartilages (Fig. 99). This disease is situated, usually, in the bodies of the *mid-dorsal* vertebræ; but extending upwards and downwards to several vertebræ, the upper or lower dorsal, or even the upper lumbar vertebræ and fibro-cartilages, may be diseased. *Abscess* forms under the anterior common ligament. The bodies of the affected vertebræ become disintegrated, and the cartilages destroyed; the spine yields under the superincumbent weight of the trunk, and gradually bending forwards forms an "angular curvature," commonly known as "hump-back"—a prominence of the spinous processes of the vertebræ posteriorly at the seat of curvature (Fig. 100). When, in rare cases, *caries*

* St. Thomas's Hosp. Mus.

to a central portion of the body of a vertebræ, the spinal column assumes its normal shape,—there is no excurvation.

The spinal column, occupying the middle line of the body and being directed laterally, it bends forward in that line without lateral deviation. The column is a flexible pillar of support, and subject to the influence of muscles. Accordingly, a person with angular curvature of the spine, and tending, therefore, to tumble head foremost, gradually loses the line of gravity. Habitually throwing the head and shoulders forward, as if with an air of pride; so that the *angular excurvation* becomes combined with *two incurvations*, one above, and one below, in contrary directions; the whole spine assuming an S-shaped profile, not unlike a double (S). If angular curvature affects the very base of the spinal column, thus allowing the whole trunk to fall forward, any such restoration of equilibrium will be impossible; the patient gropes along with the body horizontal to the ground, the trunk falling down, with the spine above the point of curvature, the head up, as if were; the ribs being compressed, and the sternum sometimes bent at an obtuse angle as a sort of counterpoise to the protuberance. The shape of the thorax is thus altered, the anterior diameter being increased and the vertical decreased. The bending of the trunk gives a pot-bellied appearance to the abdomen, the whole trunk seeming to have fallen down in a lump. The thoracic and abdominal, also undergo compression; but accommodate themselves to their respective cavities, they do not suffer any material change of structure or functions. The *aorta*, still following the course of the trunk, depends with it at the seat of curvature. Rarely is the *spinal cord* lacerated or otherwise injured; sometimes, it becomes softened at the seat of curvature, and paralysis of the parts supplied below ensues.

Symptoms.—Commonly arising in youth, and after slight exertion, back, disease of the spine commences with a sense of *ache in the back*; the patient feels some inability to stand upright, or to lean forwards, rests his hands on his knees, or avails himself of any temporary support. This sign is never absent, and it is rendered more marked by its connection also with hysteria affecting the spine. A *swelling* soon appears in some portion of the spine, usually in the lower part, and this point is *tender* or *painful* when pressed or tapped with the finger; the patient wincing when pressure falls on it in passing over the spinal column. But pain is a very equivocal symptom. It is entirely absent with marked angular deformity; and present, sometimes, persistently, in a particular spot without spinal disease, as in the case of hysteria. *Rigidity* of the spine is, however, an equally characteristic sign with falling weakness and angular deformity. It is detected by desiring the patient to stoop and raise himself up again, or by then placing the hand on the suspected vertebræ; the vertebrae will be seen and felt to move unitedly as a connected column, and loss of separate mobility is said to arise from the adhesive union of the arches of the vertebræ, forming a compensatory rigidity, as the bodies are destroyed by carious disintegration. Symptoms referable to the *spinal cord* supervene; shooting pains extend round the trunk, to the stomach, or down the limbs; and the patient has a staggering gait, with *spasmodic* affections of the muscles of the

lower extremities, or relaxation of the sphincter ani, retention of urine, or other paralytic symptoms. The angular deformity of the spine has now become well marked, and is rendered more conspicuous by *wasting* of the muscles in the trough on either side of the spinal column. The excurved ridge of spinous processes stands out like a *keel*

FIG. 101.*



(Fig. 101), with a serrated edge, the tubercle of each process being distinctly visible. The transverse and oblique processes can also be distinguished.

DIAGNOSIS.—1. *Spinal hysteria*—occasionally resembling disease of the spine, with regard to the pain, as above noticed—may generally be diagnosed by certain differential characters. The pain is severe, but superficial, and not limited to one portion of the spine; aggravated by gentle pressure on the skin, rather than by deeper pressure on the bony processes, this pain is apt to shift its position, from the dorsal to the lumbar region, or up to the neck. With this spinal condition, paralytic symptoms are sometimes associated; loss of power in the lower extremities or par-

alysis and difficulty of act in voiding the urine. But the constitutional condition remains good, or unlike that which accompanies paralysis from disease or injury of the spine. The sex of the patient—a female, and possibly some similar disorder—not disease, may supply additional diagnostic indications.

(2) *Sympathetic pains* in the back might be erroneously referred to spinal disease. These pains occur most frequently *between the shoulder, or over the scapular angle of the scapula*. The fourth, fifth, and sixth dorsal intercostal nerves are distributed to these parts; and the pains, chronic illness, are expressive of some abdominal visceral disturbance—in the stomach, duodenum, liver, or pancreas; the medium of nerves communicating being the great splanchnic nerves, which, at their lower end, are connected through the solar plexus, with these abdominal viscera, and especially with the dorsal nerves manifesting the pain in the inter-scapular region. Thus the spinal nervous system in the back here responds to a condition of the sympathetic system, with reference to the misadvice of the digestive organs in the abdomen.

CURE AND TERMINATIONS.—Abscess may undergo resolution, the matter being slowly absorbed. A process of restoration goes on also in the vertebrae. Ossous disintegration and absorption are followed by bony deposit between the bodies, in the place of inter-vertebral fibro-cartilages, thus being and consolidating the bones into one mass; while bridges of bone are thrown out from body to body, forming additional buttresses of support to the spinal column. This ankylosis is the natural cure of disease of the spine,—a not uncommon event, especially when aided by proper treatment; the patient, however, remaining deformed.

Progressing abscess represents the unfavourable course of spinal disease, in suppling the continued formation of matter and destruction of the

* Royal Free Hospital. (Author.)

column. The abscess presents or makes its appearance in a variable ;—early, with weakness of the spine and before any deformity ; or later period, after months or perhaps years. It appears in various *forms* ; according to which, abscesses connected with spinal disease are easily distinguished, irrespective of the particular parts of the column where they arise. The route of any such abscess, “ by translation,” is very devious and extensive.

POAS ABSCESS is the most common, and typical. The matter arising from the dorsal or the lumbar vertebræ, enters the sheath and substance of the psoas muscle,—passing in the former case through the diaphragm and the ligamentum arcuatum. Following the line of the muscle, the abscess descends obliquely outwards, and passing under Poupart's ligament, appears in the groin ; where, by extending upon the thigh, it may burrow under the knee, as a large and increasing femoral abscess. A *double* psoas abscess forms occasionally ; the collection of matter at the spine bifurcates, passing down within the sheaths of both psoas muscles, emerges in two places.

Symptoms.—Abscess may be detected in the groin, or even in the iliac fossa, by the usual symptoms ;—a fluid and fluctuating swelling, which is easily emptied of its contents when the patient lies in the recumbent position, and which yields a fluctuation to and fro on careful palpation of the hand placed over the iliac fossa and the other over the swelling in the groin. But the communicating channel—under Poupart's ligament contracts, whereby the abscess in the thigh becomes circumscissile and isolated ; as if it were a distinct chronic abscess, connected with diseased femur, instead of proceeding from the spine.

Prognosis.—The *origin* of abscess in the groin is various. It may be divided :—(1) from bubo or glandular abscess ; (2) from disease of the hip ; (3) from iliac abscess connected with disease of the iliac bone, or of the iliac fossa ; (4) from pericæcal abscess, on the right side only ; (5) from perinephritic abscess ; (6) from empyema, perforating the pleura and ascending behind the diaphragm. The diagnosis of *abscess*, thus varied in situation, but differing widely in origin, will be guided by the *association* of other symptoms ; the presence of other symptoms of disease, or those of one of the diseases above named. Compared with other *tumours* in the groin or iliac fossa, abscess, in these situations, differs more or less in its *own* characters. Thus, from *fatty tumour* in the iliac fossa, abscess differs in its fluid and fluctuating character and partial subsidence in the recumbent position, as compared with the solid doughy resistance and irreducibility of a fatty mass. *Femoral hernia* is distinguished chiefly by the perceptible impulse on coughing, and gurgling character of the swelling.

Progress. of psoas abscess is mostly unfavourable. The resolution of an internal abscess, which has already enlarged so far as to become permanent, is a rare event. Slowly perhaps, but surely increasing, the abscess attacks at length bursts. The general health will then inevitably undergo change. From a comparatively local state of disease,—the patient being long about a large indolent abscess in his thigh, constitutional disturbance supervenes, in perhaps a day or two, or a week or two. Hectic with great emaciation, follows, large bed-sores form, and the patient is exhausted.

OTHER SITUATIONS OF SPINAL ABSCESS.—1. *Psoas* abscess emerges from Poupart's ligament, in the narrow interval between the united bellies of the *psoas* and *iliacus* muscles and the anterior inferior spinous process of the ilium; its progress is arrested by the origins of the *sartorius* and *tensor vaginæ femoris* muscles, which incline it inwards obliquely across the thigh, in the line of the *sartorius*. But the abscess may turn abruptly inward or outward, at the groin; or coursing downwards, divide into two portions, an inner and an outer; or burrow under the muscles of the thigh, into the popliteal space, or pass thence on to the calf or ankle. Sometimes, this abscess descends into the subperitoneal tissue of the pelvis, and presents along the rectum at the anus, or emerges from the sciatic notch and passes down by the side of the trochanter.

2. *Lumbar* abscess is perhaps the next in order of frequency after *psoas* abscess. The matter passes directly backwards, chiefly by perforating the *quadratus lumborum* muscle, and forms a rounded broad flattened abscess. Its boundaries usually are the lowest rib above, the crest of the ilium below, the *sacro-lumbalis* internally, and the margin of the external abdominal oblique muscle externally. This abscess frequently co-exists with *psoas* abscess. The matter may come from the lumbar or dorsal vertebrae, having descended from the latter.

3. *Dorsal* abscess sometimes forms, by the passage of matter directly backwards. Or matter, proceeding from the dorsal vertebrae, passes down under the pillars of the diaphragm along the aorta and iliac vessels, into the iliac fossa, and comes forward through the anterior wall of the abdomen above Poupart's ligament; or, sinking into the pelvis, it escapes through the sacro sciatic notch, and collects in the *gluteal* region.

4. Disease of the *cervical* vertebrae exhibits equally remarkable varieties of abscess in respect to the situations of its appearance. The matter coming forwards, it presents behind the *pharynx*, or may descend under the sterno-mastoid muscle to the side of the *neck*; occasionally, it passes down into the *thorax*, or into the *axilla*.

PROGNOSIS.—The *prognosis* in caries of the spine is always precarious. A favourable prognosis has reference only to *anchylosis*, the patient remaining hump-backed for life. Otherwise the spinal cord is exposed; paralytic symptoms become aggravated, and abscess increasing by progressive caries of the vertebrae, at length bursts, and leads almost inevitably to the overwhelming constitutional disturbance already noticed, hectic and exhaustion.

TREATMENT.—Guided by the natural mode of cure—*anchylosis*—the primary indication of treatment is to bring about this result. Hence, absolute *rest* in the horizontal position must be observed, in order to prevent any motion affecting the vertebrae, and to relieve the weight of the trunk from the spinal column. A *prone* couch may be used daily. The prone position of the patient is preferable to the recumbent, as the angular prominence of the spine escapes compression and any tendency to congestion affecting the diseased vertebrae; both of which evils would result from a long-continued resting of the patient on her back. In this way the progress of the disease may be arrested without further measures. *Blisters*, *setons*, *moxæ*, are sometimes useful adjuncts, as means of counter-irritation; but they more commonly prove obnoxious by disturbing sleep, and enfeebling by giving rise to a draining discharge. This plan of treatment

turned for six months, a year, or more, according to the state of the disease, some degree of freedom may then be allowed to the patient, and an *apparatus* to support the trunk (Fig. 102).

The *master of Paris jacket* offers the advantage of perfect immobility, and also enables the patient to walk, and take exercise. It is a mode of treatment in favour of the general health much preferred to bed-rest. When the disease attacks the upper dorsal or cervical vertebrae, an addition to the jacket is made by carrying a support over the head, secured by straps passing under the arms, and an *apparatus* described by Dr. *Maistré*. These plaster of Paris jackets are to be renewed at intervals of one to two months.

During the whole course of the disease, the patient should have improvement of nutrition. Hence iron and quinine are most beneficial, with cod-liver oil, and a generous diet, will aid the effect of rest and of the *jacket*. Intercurrent paralysis mostly subside, when the disease progresses favourably; the patient recovering its functional power. A small quantity of bichloride of mercury, from one to the sixteenth of a grain, may be given with advantage.

A sinus, or abscess in any other part of the neck, arising from spinal disease, requires special treatment. Like any other abscess, no interference is required until it threatens to burst. It

may be aspirated, or opened by valvular incision, or a drainage-tube may be inserted, and the wound dressed with antiseptic dressing.

Disease of the Atlas and Axis, and of the Atlas and Occipital
Disease of the first two cervical vertebrae is less liable to occur, as the intervertebral substance is less osseous than in other vertebrae. Disease begins in the articulations, or in the occipito-atloidean articulations; thus, the disease is of other joints. The earliest *symptom* is *pain* in the neck, aggravated by rotation of the head, or movement backwards; and increased also by pressure on the top of the head. *Rigidity* or stiffness is experienced in the upper part of the neck, when the head is moved; amounting perhaps to an inability for a limited range of voluntary movement. But little or no swelling is perceptible at the back of the neck, below the occiput. In this painful and rigid or fixed state of the neck is followed by inflammation of the *pharynx*. Deglutition, respiration, and speech are affected, the voice having a nasal twang; while with an anxious expression on the face, and dribbling saliva, the head fixed and supported by the hands, the patient turns round bodily in looking at

FIG. 102.



swelling, and the one capable of peculiar rolling range of motion. Wasting death may gradually reduce the vertebrae, or the column terminate suddenly by ankylosis, either a process on the vertebra by dislocation of the axis forward, the transverse and accessory check ligaments having given way. The head falls forward, varying with it the axis, the odontoid process of the axis compresses the cord, and death is instantaneous.

It is said that the axis may undergo dislocation gradually, and even while the vertebrae in front of the vertebrae bend into equal parts, thus compressing the cord not half its former size, yet without paraplegia resulting. The patient may indeed recover, with permanent dislocation and ankylosis. Certain signs, however, will then be observable; a stiff and somewhat contracted neck, the chin and face advanced unnaturally, and the back of the head more in a line with the spine, while the spinous process of the axis projects conspicuously.

The cause of this disease would appear to be a scrupulous constitution, provoked probably by some slight strain or other injury affecting the neck. Primary seems to be the age at which the disease commonly begins; but it occurs also in infancy or adult life.

There must not be the same principle as that of spinal disease producing angular curvature; absolute rest by fixing the head, counter-irritation when necessary, and leeches. A post-pharyngeal abscess may be opened antiseptically, and a drainage-tube inserted, from behind the border of the sternocleidomastoid muscle.

Lateral Curvature of the Spine.—Spinal Curvature may take place laterally, to one side or the other, and with another or compensating curve to the opposite side; thus presenting



a very different appearance from angular curvature forward, with a sharp projection backwards. Lateral curvature usually forms in the middle of the back—mid-dorsal region of the spine—and with its convexity towards the right side; the second curve is in the lumbar region, and its convexity towards the left. This curve arises nearly simultaneously with the first curve, constituting *double lateral curvature* (Fig. 103). Sometimes four curves occur; namely, besides a dorsal and a lumbar, a cervical and a lower lumbar curve are produced, also in opposite directions. There will then be two curves to one side, and two to the other, arranged alternately; the whole spine having a quadruple undulatory form. The effect of this double and opposite curvation, whether in one or two pairs, is to bring the weight of the trunk over the sacrum, as the base of support, and thus maintain the balance of

the body. Another and a remarkable change takes place, concurrently with lateral curvature of the spine. In each such curve, the aberrant vertebrae twist or undergo *rotation*, to some extent; so that the anterior

of their bodies look towards the convexity of the curve, the spinous processes towards the concavity. A double kind of curvature, *lateral* and *rotary*, is the resulting structural alteration of the vertebral column. The *bodies* of the *vertebræ* become somewhat compressed in the concavity of their curve; but there is no apparent disease of the osseous structure. The *inter-vertebral cartilages* undergo compression, so as to acquire a wedge shape, the thin portion corresponding to the concavity of the curve; and the alteration of form is proportionate to the degree of curvature. The *ligaments* are simply stretched and somewhat relaxed. The *ribs* conform to the direction of the *dorsal* curvature; being thrown outwards and upwards on the convexity of the curve—towards the right side, and downwards and downwards, at its concavity—towards the left side. The *thorax*, therefore, bulges on the one side and is depressed on the other. The *pelvis* also conforms to the *lumbar* curve; it is raised, accordingly, on the side of concavity—the right, and lowered on the side of convexity—the left.

103.) *Rotation*, or the twist of the spine, produces peculiar changes; the *thorax* projecting backwards somewhat, as well as outwards and upwards, on the right side; and the *pelvis* backwards, as well as downwards, on the left side.

SIGNS AND DIAGNOSIS.—The signs of lateral curvature are obvious, and correspond to the structural alterations of conformation above described. Passing the spinal column from above downwards, by passing the finger along the tips of the *spinous processes*, some unnatural curvature of the *dorsal* spine to the one side may be perceived, with a compensating curvature in the *lumbar* region to the other side. And this line of undulation may be rendered more visible by marking it with a pen dipped in ink. But the degree of rotatory displacement cannot be determined by the line of spinous processes. The tips of these processes—which, until there is considerable displacement, are the only portions of the bones we can feel—are those very parts which in rotation move most away from the side to which lateral displacement tends; thereby allowing considerable displacement of the *vertebræ*, while the spinous processes still lie in a straight, continuous line.

Bulging of the thorax, beneath and outside the *angle of the scapula*, is an *early* sign; and followed by projection of this bone *backwards* and *outwards*—"growing out" of the blade bone, at a *later* period, with some elevation of the shoulder. This corresponds to, and denotes, the *dorsal* curve. The anterior projection of the *innominate bone*, marked by a protuberance *ward* just outside the *sacro-iliac joint*, is also an *early* sign; and followed by *lateral projection*, and *uprising*, of the *hip*, altering the outline of the figure at a *later* period. This corresponds to, and denotes, the *lumbar* curve. The change that is here observable, in the configuration—regard to the left hip, *uprising*, is due, apparently, to the depression of the ribs above—even to an acute angle, in *extreme* lateral curvature. The priority of a prominent shoulder, or of a prominent hip, denotes a *primarily dorsal* or *primarily lumbar*.

The *front of the chest* exhibits certain opposite alterations of configuration—as compared with its posterior aspect. The right side appears small and depressed, the left prominent.

Serious *displacements* of the lungs, and heart, accompany these changes in thoracic configuration, resulting in cardiac disease. Death ensued in some of my own cases.

CAUSES.—Age has an immediate relation to lateral curvature of the spine; this deformity taking place mostly about the age of puberty, and in girls. It would seem that at that period of life, and in the female sex more particularly, the bust and shoulders undergo development, and become more weighty than in proportion to the supporting stability of the vertebral column and its ligamentous connections. This naturally increased weightiness of the thorax may be augmented by certain occupations, as that of nurse-girls by carrying an infant constantly on one arm. Or again, the erector muscles of the spine, in common with the whole muscular system, may be in an atonic and weakened state, relatively to the increasing weight thrown upon them by the development of the trunk; and this muscular weakness is more liable to occur in females as a result of the anæmia from disordered menstruation. Certain occupations which compel an *habitual one-sidedness of posture*, provoke lateral curvature of the spine; as writing, drawing, playing the harp, or other exercises in the course of school training. From increasing weight of the trunk, weakness of the supporting muscles, or from both causes, favoured by any occupation conducive to the operation of either cause, lateral curvature is liable to result. *Inequality in the length of the legs*, from any cause, has some influence in producing lateral curvature. Thus, a limited importance may be attached to *shortening of one leg*; whether as a congenital defect, by dislocation, or from imperfect development; or as resulting from disease of the hip-joint, or paralysis, or from the use of a wooden leg. *Diseases of the chest*, followed by contraction of the thoracic parietes, often give rise to lateral curvature, as after tapping for empyema; and the same effect may be produced by thoracic and abdominal tumours.

But these accredited causes do not explain certain essential characters of this deformity; to wit, the great frequency of dorsal curvature to the right, and the production of rotation. Assuming that the right arm is heavier than the left, and the right lung more capacious than the left, Mr. Barwell attributes rotation to the action of the *serratus muscle* of this side; which muscle being more weighty and in stronger respiratory action than its opponent, acts upon the ribs as powerful levers, and thus rotates the vertebra to the left side. In this etiology, the sequence of events, as usually described by authorities on lateral curvature, is reversed. It is generally stated that the spine first curves laterally, then rotates, and in this latter movement, by dragging with it the ribs, deforms the chest. The rotation-theory affirms that the ribs are primarily drawn backward, and acting as levers, twist the vertebra to the left, curving the dorsal spine to the right.

TREATMENT.—Any cause in operation must be removed. Thus, any *one-sided posture*, connected with occupation or habit, must be corrected; and the patient allowed free motion of the body, alternated with rest in the recumbent position.

In the correction of posture, in the production of lateral spinal curvature, the *slaying nut* is brought about by an *antagonistic position*. This may be accomplished by using the *slaying nut* (Fig. 104). By uplifting the left side of the trunk, when depressed by lateral curvature having a lumbar curve, or by the right side, when the spine is compelled, by the law of equilibrium, to curve to the opposite direction,—to the right, for maintaining balance; and a *corrected position* is established. The results of this mode of

treatment are said to have been "perfectly marvellous." Various *gymnastic exercises* have been recommended, and may be of some use; but the ordinary exercise of walking and running will probably bring both sides of the body into equal action, and the spine naturally regain a straight direction.

(2.) *Spinal supports*.—1. In *single lateral dorsal curvature*,—say, dorsal *right*, unaccompanied by any compensatory curve in the lumbar region, a spinal support may be worn, having a thoracic plate, on the *same side*, and *opposite* to the convexity of the curvature.

2. In a more *advanced stage*, and as *double lateral curvature*, some other

FIG. 104.



FIG. 105.



mechanical means must be had recourse to for the gradual correction of this deformity.

A contrivance may be worn, to relieve the weight of the trunk by *crutch-supports*; and the varying degrees of lateral pressure requisite, can be *regulated* by a rack and pinion worked by a key. The primary dorsal curve may be "unfolded," by extending its extremities (Fig. 105); in this way restoring the line of the vertebral column. Unfolding is accomplished, most effectually, by raising the upper extremity of the curve, and supporting its convexity at the same time, as shown in the figure.

Posterior Curvatures of the Spine.—*Cyrnosis* is a term intended to signify an *excurvation* of the spine in the dorsal region, exhibiting a remarkably *round-backed* appearance.

Lordosis denotes *incurvation* in the lumbar region, and is of more rare occurrence. Both these spinal curvatures appear to be simply an enlargement of the natural curvatures existing in their respective regions; they

occurs as a natural tendency in *rickets*; the pelvic bones y weight of the trunk, the sacrum inclines forwards, cari lumbar portion of the vertebral column. The influence witnessed in the lumbar lordosis of tumbling boys and of the lumbar vertebræ is attended with an arching forward or a secondary and compensatory curve forms in this direction from disease in the dorsal region. *Disease* of the especially after ankylosis with flexion of the femur, is accompanied with lumbar lordosis, as well as some lateral *reduced dislocation* of the *femur backwards*, or similar condition of one or both hip-joints, results in lumbar incurvation.

TREATMENT should be conducted on the same mechanical counter-support or pressure, gradually applied, as in the lateral curvature. The apparatus for *Cyphosis* consists of support, placed just *below* the transverse axis of excurvation, an iron rod from the pad, resting below in a metallic *Lordosis*, a stay-apparatus should be worn, having supports to relieve the weight of the trunk, but provided with a back-plate, or an abdominal band; the former appliance is used for anchylosing angular curvature. As in *rickets*, or with lateral curvature, the treatment of dorsal lordosis is the same; and so also in the management of these conditions; and so also in the management of *rickets* with *rickets*.

Spina Bifida.—A congenital malformation, signifying a deficiency of the laminæ and spinous processes of some of the vertebrae, with protrusion of the membranes of the cord through the defect left in these bones. The *sac* formed contains a thin, fluid, cerebro-spinal, which accumulates as the protrusion of the spinal cord, resulting from an arrest of development in any part of the spinal column; in the *lumbar region* it is most common; in the *dorsal* or *cervical* region, rarely. The *spinal cord* and its membranes are generally involved; but above the *lumbar region*, they are not; and the *spinal cord* is adherent to the interior of the *sac*; or lower down, in the *lumbar region*, the *spinal cord* is adherent to the interior of the *sac*. The *signs* of *spina bifida* are obvious. A round

according to the size of the tumour. If the sac be small and remain stationary, it may not shorten life. A large sac generally has a fatal termination; death occurs from convulsions, or inflammation and ulceration of the integuments taking place, spinal meningitis supervenes.

TREATMENT.—This also, guided by the probable course of the tumour, will depend on its size. A *small* sac, with healthy integuments, is best left alone; the patient wearing a soft pad over the tumour, simply as a farther protective covering. A *larger*-sized sac, and with the integuments in the same healthy state, may be restrained by a *compress* and bandage; an india-rubber air-pad affords the most uniform and elastic support. Increasing tension can be relieved by *puncture* as occasion requires, and pressure should then be reapplied. Extirpation has been resorted to successfully; but this procedure, or indeed any operative interference for removal of the sac, is always more perilous than the tumour itself.

THE THORAX.

CHAPTER XLIV.

INJURIES OF THE THORACIC PARIETES, AND ORGANS.

Injuries of the chest are common accidents in Civil Practice, while they form a very important section of Military Surgery. The chief practical distinctions of these injuries are as follow.

Wounds of the Parietes of the Chest.—These lesions, *not penetrating* the thoracic cavity, present nothing peculiar in their pathology and treatment. Rest of the injured part will be best secured by means of a broad rib-bandage, thus restricting the breathing to abdominal respiration, as in the treatment of fractured ribs or sternum.

Injuries involving the Thoracic Organs.—Whatever part of the thoracic parietes be injured—the ribs or sternum; and whatever internal organ be implicated—the lung, heart, or great vessels; certain symptoms are common to these injuries, coupled with special symptoms according to the situation of the injury as implicating a corresponding internal organ.

CAUSES.—*Fracture* is the most frequent form of thoracic injury in connection with wound of the lung, the pericardium, or heart; the ribs or the sternum, respectively, being the seat of fracture, and the broken ends of bone, thus driven inwards, being the immediate cause of the injury to either thoracic organ. *Contusion* or *compression* of the chest, without fracture, as by a violent blow or squeeze, may directly rupture the lung, pericardium, or heart, and, possibly, the diaphragm. Lastly, a *penetrating wound* of the chest, as by a stab with a knife, a bullet, or other gunshot

injury, may also directly implicate either organ; but this occurs of internal injury is comparatively rare in civil life.

Symptoms.—The shock of injury is always well marked, with perhaps faintness from loss of blood, amounting sometimes to extreme collapse; although this state may be partly due to terror or depression.

(1.) If the *Lungs* be wounded or ruptured, there is also sudden dyspnea, with a tickling spasmodic cough and bloody-foamied expectoration, a considerable hæmoptysis of pure blood. As arising from gunshot wound of the chest, involving the lung, hæmoptysis may not occur until after the lapse of several hours, or even days. But spitting of blood is no certain indication of the lung being wounded; for this symptom may arise from contusion or compression of the chest. Bloody expectoration, or even hæmoptysis, is therefore not to be regarded as a pathognomonic sign that the lung is wounded, in connection with a penetrating wound of the thorax.

The air inspired escapes at the seat of pulmonary lesion, into the cavity of the pleura; constituting *pneumothorax*, with proportionate collapse of the lung. If the costal pleura also be wounded, the imprisoned air, passing during expiration from the pleural cavity externally, infiltrates and distends the cellular texture, perhaps to a great extent; constituting *emphysema*. But this symptom also may be absent; as when a penetrating thoracic wound is of large size, so that no air collecting in the pleural cavity, there is none expelled. And the escape of air affords no sure evidence of lung-lesion; for air passes in and out of the pleural cavity during respiration, when the wound is of small size. Hemorrhage taking place into the pleural cavity is known as *hæmothorax*. The lung may protrude to some extent through a penetrating wound of the thorax, forming *hernia* of the lung.

If the **PERICARDIUM** or the **HEART** be wounded or ruptured, there will be extreme collapse. But the chest has been completely transfixed, without vital injury.

The **CONSEQUENCES** of injury to the *lung* may be: inflammation of that organ—*pneumonia*; and with regard to the pleura—*pleurisy*; terminating perhaps in pus-formation and its accumulation within the pleural cavity—*empyema*. Injury to the *pericardium* is followed by *pericarditis*.

But more than half the cases of gunshot wounds of the chest die.

TREATMENT.—A penetrating wound of the chest presents certain general indications of treatment. (1.) *Hæmorrhage* must be arrested. The wound may be accompanied with hæmorrhage from two sources: the arteries of the parietes, or the vessels of the lungs. The former are less frequently the source of hæmorrhage. An *intercostal artery* is seldom wounded, the vessel lying under cover apparently of the groove in the lower border of the upper rib of the two. Yet occasionally the artery bleeds freely, even to the amount of four pounds of blood, into the pleural cavity. The integumental wound must then be enlarged, if necessary, to reach the bleeding vessel, which may be secured by *ligature* or *torsion*. *Compression* may sometimes be more practicable; and this is best accomplished by introducing a piece of rag in the form of a bag, and stuffing it with small pieces of lint, so as to compress the vessel effectually on drawing the stuffed bag outwards. There is no special risk of thus inducing inflammation of the pleura or lung; and, in any case, this danger should be

encountered in order to arrest otherwise uncontrollable hæmorrhage. For the mortality consequent on wound of the intercostal arteries is very high; 13·4 per cent. The *internal mammary* artery, which is rarely wounded, must be ligatured or twisted, the external wound being enlarged when necessary for this purpose. The costal cartilage overlying the artery may be divided in order to reach the vessel. Blood extravasated into the anterior mediastinum or the pleura, can be partly withdrawn through a female catheter or by the application of a cupping-glass. *Pulmonary* hæmorrhage is the chief source of danger; but the treatment is constitutional, and will be specially noticed after completing the local management of the wound. (2.) *Foreign bodies* are sometimes discovered, on carefully examining the wound by gently introducing the finger. A probe should never be used, lest a simple integumental wound be thus accidentally converted into a penetrating wound of the chest. But the Surgeon must not forget that although, when the chest is perforated, one of two balls, or a portion of a split ball, may have lodged; yet, with only one opening in the chest, the ball may have fallen out, or have been withdrawn in a pouch of clothing. Any foreign body within reach that can be fairly *extracted*, or by enlarging the wound, must be removed; such as clots of blood, a splintered bit of rib, or a bullet. If *not accessible*, the substance had better be left to find its way out; or, remaining within the chest, it may lead to the formation of abscess and be coughed up with purulent expectoration, or perchance be expelled through a fistulous channel in the wall of the thorax; or, the body may become encysted in the lung and quiescent, thus lodging in the chest for years. A bullet has been known to continue rolling loosely about in the pleural cavity.

(3.) The *closure* of a penetrating wound of the chest should be determined by two considerations: the probability of a foreign body not remaining in the wound, and by whether the lung be wounded. 1. A *small* puncture, without the escape of air and blood during expiration, and unaccompanied with bloody expectoration, is a condition which permits of the wound being *closed*. This can be done by means of the ordinary appliances; one or two sutures perhaps, a pad of lint, and strips of plaster. A rib-bandage also may be used to restrict the breathing to abdominal respiration. 2. A wound of the chest which *involves* the lung, as shown by air and blood escaping through the wound from the injured lung, is a condition wherein the external aperture should *not* be *closed*. Water-dressing may be applied, but the patient should be placed on the wounded side, in order that the air and blood may be freely discharged. Pneumothorax and the tendency to emphysema, and perhaps hæmothorax, will probably thus be prevented. This general rule, as to the position of the patient, must not be made absolute. If the position prove intolerable, he may be allowed to lie in whatever position is most comfortable to him; but the almost inevitable consequences of an unsuitable position should not be overlooked. On the other hand, *three exceptional* conditions are worthy of notice, in either of which the proper practice will be to *close* the wound, *although* the lung be *involved*. With pneumothorax to such an extent as to threaten suffocation, the external wound should be closed, at least, so long as the breathing is thus relieved; with pulmonary hæmorrhage, and blood escaping through the external wound to an amount which threatens fatal syncope, the same precaution should be taken, in order

that, by allowing the blood to accumulate within the pleural cavity, a compress may form over the pulmonary wound,—but, in the event the breathing becoming oppressed, the thoracic wound should be at once reopened to discharge the blood; lastly, with perforation of both pleural cavities, the admission of air should be prevented, which would otherwise soon prove fatal. Under these circumstances, it may be advantageously adopt the method of “hermetically sealing” the wound,—by a metallic suture, and wool-compress saturated with collodion, as practised with more or less success by Dr. Benjamin Howard, United States Army.

Constitutional treatment consists in the remedial measures appropriate for arresting pulmonary hæmorrhage. Perfect quietude, so that the patient may lie as placid as possible, must always be enjoined; for the pulmonary texture evinces a strong natural disposition to heal. Stimulents may then be administered with advantage, and in particular acid, alum, or acetate of lead and opium in pill. Opiates are also resorted to by insuring sleep, and diminishing the respiration. The efficacy of letting in reducing the force of the circulation, as originally inculcated by John Bell, Hennen, and Guthrie, was corroborated by the large experience gained during the Crimean War. *Venesection* should be had resorted to early and copiously, sixteen or twenty ounces of blood being drawn at once, and repeated to a lesser amount again and again, whenever necessary to suppress hæmoptysis. More recent experience during the American War is adverse to the practice of blood-letting. I am in favour of a decided and, as it may be termed, knock-down abstraction of blood, the pulmonary lesion will probably undergo repair sufficiently to arrest hæmorrhage before the pulse rises and bleeding can recur.

AFTER-TREATMENT.—(1.) *Inflammation* supervening after about the third day, it should be met by the usual antiphlogistic treatment. To this difference, that antimony and mercury are scarcely appropriate, on account of their influence in checking the exudation of plastic lymph requires the reparation of the wounded lung.

(2.) *Secondary hæmorrhage* may arise from inflammatory excitation of the circulation, or after gunshot wound, by the detachment of a clot from the blood proceeding either from the lung, or from an injured interlobular artery. *Venesection* is the remedy in the first case; with *ligature of the artery* in the second; and astringents in either case may prove serviceable. The *pleural cavity* may have become filled, and the lung compressed by air, extravasated blood, or inflammatory effusion, serous or purulent. The *wound* should then be opened with a probe-pointed bistoury, as soon as it is given to any such collection. Or, when the wound has closed, it may be necessary to *tap* the chest; an operation which, in the American War, was attended with a death-rate of eighty per cent.; but this mortality is not much higher than that from penetrating gunshot wounds of the chest, without such operation.

In connection with gunshot wounds of the chest, it may be necessary to perform the operation of *excision*, for the removal of portions of the ribs either as the fragments in compound and comminuted fracture, or on account of caries or necrosis. Such operative procedures must be governed by general principles, and admit of no special description. Thus, portions of the ribs or the sternum, of the clavicle or the scapula, have been removed with more or less success.

ia of the Lung, or Pneumatocele.—Protrusion of the lung w a *penetrating wound* of the chest, or a stab, or gunshot wound; after the external wound has healed, it appears under the *cica-* it has been produced by fractured rib *without wound*, or by any raining effort, as during labour, or in consequence of the habitual of a wind instrument. The *lung* itself is seldom wounded, in n with its protrusion. If the *pleura* be adherent close to the wound, or seat of rupture, protrusion will be more likely to hereas, if the lung be in a collapsed state, as with a large thoracic he liability will be less. Any part of the thoracic parietes is hernia of the lung; but more especially one or other side of the he *tumour* may attain a large size. Owing to the vascularity of onary texture, and the existence perhaps of a small aperture, a g portion soon becomes *strangulated*; it acquires a deep purple colour, and being almost insensible to the touch, it appears as if of gangrene. But the Surgeon may well doubt this event, until r has changed into black or grey, and the texture has become by disintegration. Inflammation is liable to *extend* along the ading to adhesion or effusion.

a covered with integument, hernia of the lung might be *mistaken* bulging of a purulent collection in the pleura,—*empyema*. But ction may be perceived by percussion and auscultation. Strangu- dom supervenes, as after protrusion from wound.

TMENT.—(1.) With an *external wound*, and the protruding lung thy state, it may be *returned* into the thorax, while the patient leep breath; or it may be found necessary to slightly enlarge the with a probe-pointed bistoury and director, observing to cut across e of the intercostal muscular fibres. But no enlargement of the as required in any of the seven cases which occurred during the a War. The treatment otherwise is that of a penetrating chest Or, the protruding portion of lung may be allowed to remain as the *pleura*, when it soon granulates and heals over. This should be the rule if the pulmonary texture be bruised and lacerated, oughy state. Such an exposed portion has been known to slough has also been removed surgically and successfully, even although lerable size. Tulpus *ligatured* a gangrenous protrusion of the d cut it off with scissors. The piece removed weighed three et the patient entirely recovered. (2.) *Hernial* protrusion must rted by a truss.

mothorax.—Distension of the pleural cavity with *air*, and an aying collapse of the lung, is denoted by certain marked *signs*; tic *resonance* on percussion, with an absence of the respiratory and an increased or puerile respiration on the opposite side of the discovered by auscultation. The affected *half* of the *thorax* is and the ribs are raised; there is also some bulging of the al spaces. But the *movements* of *respiration* are *diminished* on , and the breathing is of course embarrassed in proportion to the istension and pulmonary collapse.

CAUSES of this condition are, surgically, any occasion of *wound ing*; whether by a fractured rib, rupture from thoracic compres- a penetrating wound of the chest, as by a stab or bullet. But

pneumothorax may also arise from a *diseased* state of the lung, as the bursting of a pulmonary abscess into the cavity of the pleura; air and fluid thus co-existing in this cavity, the fluid below and the air above. *Two distinctive signs* are then presented: a splashing sound elicited by succussion or shaking of the chest; and metallic tinkling, a clear, silvery, bell-like sound, resulting perhaps from the dropping of fluid occasionally from the pulmonary orifice into the fluid collected at the bottom of the pleural cavity. Coughing will frequently elicit this sound.

TREATMENT.—The relief of pneumothorax is easily accomplished by *tapping* or puncturing the chest so that the accumulated air shall escape from the pleura,—the operation of paracentesis thoracis. But the causes of which pneumothorax is itself only symptomatic must then be attended to, as in the treatment of a penetrating wound of the chest.

Emphysema.—Distension of the *cellular texture* with air frequently accompanies pneumothorax; although either condition may occur independently. Emphysema almost necessarily depends on a *wound* of the *costal pleura*, in conjunction with that of the *pulmonary pleura*; air escapes into the pleural cavity with each inspiration, and is expelled thence into the cellular texture. If the lung be bound down by *adhesions* at the seat of both apertures, the air passes directly into the cellular texture; emphysema arises *without* any previous *pneumothorax*. In this condition, the emphysema may become extensive; but when the pulmonary and parietal apertures are not adjoining, the emphysema will be limited, and disappear, as the *pleural distension* collapses the lung. An *external penetrating wound* will also allow air to pass directly into the cellular texture, thus giving rise to emphysema.

A rare mode of production, which Mr. Hilton has described, is by *rupture* of the pulmonary texture alone; air passing into the posterior mediastinal cellular texture, along the course of the nerves and vessels, thence to the neck, and downwards along the sheaths of the arteries to the limbs.

The **SIGNS** of emphysema are distinctive; a *swelling*, *diffused*, somewhat *elastic*, but plainly *crackling* under *pressure* with the fingers, and without any discolouration of the integument. This swelling arising in the neighbourhood of a fractured rib, or around the margin of a penetrating wound, *gradually extends* through the cellular texture over the thorax. Sometimes it passes up into the neck and arms, and downwards to the lower limbs; such general emphysema presents the singular appearance of a stuffed figure scarcely human, and as the internal organs become involved, dangerous symptoms arise, particularly dyspnoea, threatening suffocation.

The superficial crackling of emphysema must not be confounded with the crepitation of pneumonia, which may be consequent on the injury.

TREATMENT specially for this condition may not be requisite. The air infiltrated often becomes absorbed rapidly, and the swelling disappears. *Bandaging* may have some repressive and absorbent effect. *Punctures*, well placed, more decidedly control the spread of emphysema; and an external wound, when present, may sometimes be opened with advantage to aid in discharging the imprisoned air. Should respiration become oppressed, *venesection*, freely employed, will often afford the most marked and instantaneous relief.

Hæmothorax.—The presence of *blood* in the pleural cavity gives rise to different signs from those of Pneumothorax. Hæmorrhage may be suspected by *dulness* on percussion, with absence of the respiratory murmur,—these signs being more marked at first over the most dependent portion of the pleural cavity, where the blood collects; dyspnœa is more or less urgent, and collapse; and all these signs or symptoms are found to have arisen in connection with a *fractured rib*, or a *penetrating wound* of the chest. The blood may proceed from the lung or from an intercostal artery. Secondary hæmorrhage, and the circumstances under which it supervenes, may also produce hæmothorax. Blood thus extravasated soon undergoes *putrefactive* changes, and leads to the formation of pus in the pleural cavity—*empyema*. Sometimes there is a collection of air above the level of the blood,—a *co-existing pneumothorax*; and then percussion elicits a tympanitic resonance *above* the line of dulness. But the respiratory murmur is equally absent all over that side of the chest.

TREATMENT.—1. An *early opening* must be made, both to relieve the breathing and to prevent the risk of empyema. Advantage should be taken of an external wound to make that the vent; a probe-pointed bistoury being carefully used to free the opening. A cupping-glass may be applied to withdraw the blood, if it be not readily discharged. 2. If the hæmorrhage be *persistent* and symptoms of hæmothorax return, the plan recommended by Guthrie may become advisable. The *wound is to be closed*, so that the blood accumulating in the pleural cavity shall compress the orifice in the lung, and thus arrest any further hæmorrhage; the patient lying on that side as an additional pressure on the wounded and bleeding organ. After the lapse of six or eight days, the wound should be reopened, or tapping may be performed, to evacuate the imprisoned blood; which, if allowed to remain longer, would probably provoke empyema.

Hydrothorax.—A collection of *serous fluid*, or water, in the pleural cavity, may be the result of pleurisy; but more commonly this condition arises from disease of the heart or lungs, obstructing the circulation. Both sides of the chest may be affected.

The **SIGNS** are those of empyema, without the accompanying hectic fever.

TREATMENT surgically has regard only to the relief of dyspnœa by evacuation of the imprisoned fluid,—the operation of *paracentesis thoracis*.

Empyema, or Pyothorax.—A collection of *pus* in the pleural cavity is usually the consequence of pleuritis; induced by a wound of the pleura from a fractured rib, or a penetrating wound of the chest. The lung may, or may not, be implicated. Occasionally, the irritation of a carious rib, or the bursting of an abscess into the chest, is the cause of empyema.

The **SIGNS** are *dulness* on percussion and absence of the respiratory murmur at the lower part of the chest, up to the *level of the fluid*; this varying with the upright or recumbent position of the patient. *Egophony*—a bleating or reedy voice-sound, something like Punch's voice—is heard at the upper part of the chest; owing probably to a thin layer of fluid rising up between the two layers of pleura, through which the voice is transmitted, as a broken vibratory voice, from the larger bronchial tubes. Pus continuing to collect in the pleura, the line of percussion-dulness gradually rises higher and higher; until the *whole* side of the chest emits a wooden sound on percussion, and neither *breath* nor voice sound can be heard. The

affected *half* of the *thorax* is *increased* in size, visibly and palpably, and as shown by measurement, compared with the opposite side. The ribs are elevated, and the intercostal spaces are widened and bulge outwards; while the lung is compressed backwards towards the spine, becoming consolidated like unto the consistence of india-rubber, and ultimately perhaps not larger in size than a fist. Empyema of the left pleural cavity *displaces* also the heart towards the right side; or, if it occur on this side, the liver is depressed by the pleural accumulation. On either side, empyema may displace and compress the opposite lung. The *respiratory movements* are restricted on the side of empyema, and dyspnoea is more or less urgent as the disease progresses. *Hectic* fever results from continued suppuration. The *abscess* usually *points* and bursts externally, between the ribs; or, having become extra-pleural, the pus diffused in the cellular texture may burrow among the muscles of the back, or find its way into the abdomen, beneath the peritoneum, and even thence down into the pelvis.

TREATMENT surgically consists in evacuation of the imprisoned fluid.

Paracentesis Thoracis.—*Tapping* the chest is an operation for the evacuation of any fluid—air, blood, serous fluid, or pus—collected in the pleural cavity; but it is especially and more commonly performed for the relief of the latter accumulation,—empyema.

The *spot* selected for puncture is wherever the abscess may have pointed, or where there is decided *dulness*,—that the lung shall not be wounded; and the place usually chosen is in the fifth intercostal space, at about its middle on the side of the chest. This about corresponds to the insertion of the serratus magnus. A *valvular opening* is made in the skin, by drawing it upwards with the finger, from the lower to the upper margin of the sixth rib, a slight incision being made at this spot, with the point of a bistoury; a large-sized, flat-shaped trocar is then thrust directly over the *upper* margin of the rib, thus avoiding the intercostal artery, and passed through the pleura. The trocar is withdrawn and the fluid drawn off through the cannula. Air is liable to enter the thorax towards the end of the stream; it having become almost dribbling, air may then be sucked into the pleura during expiration, to fill up the thoracic space unoccupied by the collapsed lung. Decomposition of the purulent fluid would thus be induced, and severe or fatal constitutional disturbance; the air also preventing re-expansion of the lung. To obviate any such risk, the cannula should be provided with a stop-cock, which is turned as the trocar is withdrawn; an india-rubber bag is then attached to the projecting end of the cannula, and the fluid safely drawn off; the stop-cock being turned, and the bladder emptied and reapplied, as often as may be necessary to evacuate the purulent collection. A *modification* of this method is that which I prefer. A long india-rubber tube, instead of the bag, having been fixed to the cannula and its free end placed in a basin of water, the fluid is drawn off as safely under water, and with the advantage to the Surgeon of his being enabled to see when the stream ceases. On withdrawing the cannula, a pad of lint is slid over the puncture-orifice in the integument, and secured by strips of plaster. But if there be a *foreign body* in the thorax, as a bullet, portion of clothing, or a piece of dead bone, the opening should be maintained, or even enlarged, in order to facilitate its escape, or removal by surgical interference.

Aspiration—a simple and safe procedure—has become a substitute for

the operation of paracentesis, in cases where the fluid is found to be sufficiently *thin* to escape through one of the larger-sized aspirator-needles, or the tube may be screwed on to the cannula of the thoracic trocar.

After the operation of paracentesis, a *rib-bandage* may be used to restrict thoracic respiration.

The *drainage-tube* has been employed to prevent any reaccumulation of pus. A long iron probe, slightly bent, is introduced through the trocar opening, and pressed against an intercostal space posteriorly, as low down as possible. The prominent end having been distinctly felt, it is cut down upon, and pushed out. A silk thread carrying the drainage-tube is attached to the eye of the probe, and on withdrawing the probe at the lower opening, the drainage-tube follows through the pleural cavity; the ends of the tube, projecting from the opposite openings, are tied together, and the purulent fluid drains away, *guttatim*, as it forms. For the purpose of cleansing the pleural cavity, injections of tepid water, or weak disinfectant solutions of the chloride or bromide of potassium, are very efficacious; but any such fluid should be thrown in with the utmost gentleness, and in moderate quantity, the patient being turned round from one side to the other, so as to rinse out the interior of the cavity.

Hydrops Pericardii.—A collection of water in the pericardium may result from the same causes obstructing the circulation, as those of hydrothorax; the two conditions not unfrequently co-existing.

The **Signs** are—*percussion-dulness*, extending over the whole *pericardiac region*, and absence or muffling of the cardiac impulse, with perhaps an obvious *fulness* to the eye, and to the hand placed over this region. There is constant *præcordial oppression* and *dyspnœa*, particularly in the recumbent posture, and faintness on exertion.

Paracentesis Pericardii may be employed as a last resource. A spot of the greatest dulness having been selected, a slight incision is made in the intercostal space, and a small trocar passed obliquely into the pericardium; or the aspirator may be here employed.

CHAPTER XLV.

DISEASES OF THE BREAST.

THE Breasts—meaning thereby the Mammary Glands—are intimately related, *physiologically*, with the organs of reproduction in the female. A healthy condition of these organs is associated with a healthy state of the breasts, and both undergo differences of functional activity at different periods of life;—before puberty, at puberty, and subsequently, during the menstrual period; and during pregnancy, parturition, and lactation.

Inflammation. — Mastitis.—Among Diseases of the Mammary Gland, none is more common than inflammation of this organ. A suckling woman having, perhaps, experienced a shuddering chill, feels some uneasiness, rather than pain, in moving the arm or in the act of suckling.

and *redness* supervene with *acute pain*, commencing from lobular induration; and the established inflammation gives considerable constitutional disturbance or inflammatory fever, in

Suppuration usually takes place, within a period varying from four hours to a few days,—resolution being a rare termination. Pus collects in the breast, on its cutaneous surface, or behind the formation of mammary abscess may, therefore, be either *superficial*, *intra-mammary*, or *sub-mammary*. These different situations can only be distinguished by careful palpation with the finger, and the depth of fluctuation. 1. Super-mammary abscess is sometimes attended with *acute pain*; it enlarges to the size of a *walnut* or small egg, in about a week or fortnight. 2. Intra-mammary abscess may involve the whole gland, in one or more cavities, thus attaining to a much larger size, and it comes to the surface more slowly, bursting usually not in perhaps from two to four weeks. While imprisoned within the capsule of the gland, progressive suppuration is attended with increasing and sickening pain, with a sense of increased weight and tenderness, and a focus of purplish integument and an area of yielding softness, the opening which gives relief. The kind of discharge is distinguished by its source; being a *mixture* of *pus* and *milk*, a quantity of thick yellow streaked with white curdy fluid, rolls out of the opening. 3. Sub-mammary abscess is the most characteristic. The breast seems to rest on a hard, projecting by something behind it, presenting a tumour of a globular shape and which yields, on slight pressure, the *elastic fluctuation* of a cushion, with perhaps scarcely any integumental tenderness, although the skin looks tense and shining, and is traversed by a line. But there is deep, dull, *heavy pain*. Abscess under the skin is not necessarily connected with mastitis; it sometimes appears as a separate affection, and always acquires a considerable size, passing even beyond the boundary of the gland. The matter progresses towards the surface slowly; it *points* very often, at *several spots* around the *circumference*

ences generally within a *month* after *parturition*, or even in the *week* of lactation. But the abscess is often consequent on *prolonged* *ing*,—occurring in the course of many months. During *pregnancy* *weaning*, the inflammation happens very seldom; more frequently the former than the latter period, and when at the time of *weaning*, generally excited by a sudden cessation of suckling, or suppression of milk-secretion—owing to the death of the infant or illness of the mother. Some *local irritation*, not unfrequently, induces it; especially friction of the nipple, the irritation of sucking, obstruction of a milk-duct, contusion or exposure to cold; and occasionally a diseased state of the mammary glands. *Sub-mammary* abscess, when independent of mastitis, proceeds from *caries* or necrosis of the *ribs*, or *empyema*, by perforation of the thoracic wall.

TREATMENT.—In the *first* instance, *repressive* measures should be employed; cold lotions, or the extract of belladonna thickly spread on lint and well applied over the whole breast, a most effectual means for incipient inflammation during lactation; occasionally, leeches are advisable, and derivative aperients when circumstances permit. Local and special relief is afforded by emptying the gland-tissue of secretion; removing, in fact, lactic congestion. Suckling may be continued, but it will often be necessary to use the *breast-pump*, for the complete evacuation of the milk, and from a full breast. The arm of the affected side should be placed at rest, and the weight of the breast supported on the patient's chest; or if she lie sideways, a pillow or loop of broad cloth may be requisite. *Established* inflammation, with redness of the skin and almost inevitable abscess, must be met by warmth and moisture; measures, to limit the inflammation and induce suppuration of circumscribed matter, and facilitate pointing of the abscess. The usual rule of an incision free, and corresponding *incision* is here imperative; the protracted abscess is at once relieved, and gland-structure saved. A second or a third opening is often required, to avert the special tendency to fistulous communications, as further pointings take place around the gland. In any case, a strip of lint or a *drainage-tube* should be inserted for two or three days.

The support of lint-pads, with a bandage, will be requisite to prevent the tendency to bagging of matter and formation of sinuses, and, subsequently, to promote absorption of the remaining *induration*, when the use of *cross-strapping* with long strips of adhesive or soap plaster will usually afford a more even and suspensory support to the breast. *Sinuses* are generally closed by pressure, and perhaps occasional syringing with diluted mineral acid, the nitric, nitro-muriatic, or sulphuric acid. But an intractable sinus may have to be laid open with a bistoury and director, in order to secure granulation from the bottom. After the formation of a sinus, *suckling* with the affected breast should be discontinued, lest the flow of milk draw matter with the milk; and sometimes even the flow of milk from the sound breast provokes a sympathetic secretion in the opposite breast, and then the child should be entirely weaned.

Chronic Mastitis, as the consequence of acute inflammation, will be recognized. *Induration* and *swelling* of the breast, in part or of the whole gland, is usually followed by suppuration, burrowing, and sinuses or abscesses of an obstinate character.

AGNOSIS.—(1.) Chronic *abscess* must be distinguished from cystic-

tumour of the breast. Both having, perhaps, a painless and an indolent character, the *partly solid* consistence of the tumour, with the *history*, will generally distinguish it from abscess, and *puncture* with a grooved needle will always determine the diagnosis. (2.) From a *cancerous* tumour, the differentiation of abscess requires attention. The *partial* softening of the hard *scirrhous* tumour can scarcely be mistaken. But *encephaloid* cancer presents a tumour, circumscribed, and having a globular, although lobulated form, soft and even fluctuating, with venous discolouration, and perhaps some œdema of the integument. The distinction may be drawn by observing the more *regularly rounded* shape and the *circumferential thickening* of chronic abscess,—which is thus not so discontinuous from the surrounding mammary structure; and the *absence* of adhesion of the integument, enlargement of the axillary glands, or evidence of constitutional infection. Here, again, the *history* of chronic abscess, as having been preceded by some inflammatory symptoms, compared with that of encephaloid growth, must also be taken into account. Lastly, *exploratory puncture* will procure pus, or broken-down encephaloid substance, which should be submitted to microscopic examination.

TREATMENT consists in the evacuation of matter, as occasion requires, and the support of strapping or bandaging; with a tonic and nourishing course of general treatment. *Chronic sinuses* may be closed by stimulating injections, or by laying them open as a last resource. Milk fistulae will not usually heal until the secretion of the gland is arrested.

Inflammation of the Nipple and Areola.—This affection usually arises during suckling, and often leads to the formation of abscess, or to superficial ulceration or *excoriation*, *cracks*, *fissures*, or *chaps*. It is especially apt to occur in women during the first lactation; and the irritation of suckling may be increased by some excoriation, crack, or eczematous affection of the part, as a concurrent cause of the inflammation. Great pain attends the act of suckling, and inflammation of the breast may be induced.

TREATMENT.—Frequent *ablution* with warm water often proves more remedial than lotions, ointments, or other applications. These may be simply *protective*; as collodion, glycerine, almond oil, or some dry powder, as prepared chalk or flour dusted around the nipple; stimulating applications, as a touch with nitrate of silver; astringents, as tannin or zinc ointment; and narcotics, to relieve pain. The difficulty is to manage the breast in a state of secreting activity, and the suckling of the child, the nipple or perhaps both nipples being sore. Some of the above-mentioned applications would be decidedly poisonous to the infant; narcotics in particular. Various *shields* have been devised to protect the nipple from the pressure and dragging caused by the act of sucking; and such a contrivance will also shield the infant's mouth from any noxious matter left around the nipple, in the use of these curative applications.

Chronic Induration of portions, or of the whole, of the mammary gland is a common condition; the induration having a finely *lobular* or *granular* character, owing to the acini or caecal terminations of the lactiferous ducts being gorged with epithelium. This "lumpy" state of the gland—first described by Velpeau as "*induration en masses*"—may be found in breasts of all sizes and shapes; in the large, heavy, pendulous breast; and in the small, atrophied, disk-shaped organ. The one feels like a *globe* beneath the integuments; the other, under which the tips of the

be inserted, feels like a *quoit* covered with skin. Great tenderness, amounting to agony, on the slightest handling, is often present; the patient's face becoming suddenly suffused with a bright redness, or pallid, while a sensation of nausea or faintness oppresses her. These are two other characters besides its *intensity*; it is *widely diffused*, shooting up the neck, or behind to the back, and particularly to the axilla, often down the arm; and it may be traced to the middle or branches of the intercostal nerves, which are painful on the pressure, the filaments of the painful nerve or nerves being discovered in the indurated portion of the breast; the pain is also *paroxysmal*, passing from one breast to the other as an alternate affection.

Signs.—1. No trace of any *inflammation* of the integuments can be detected, nor of the mammary gland itself, and even when a portion of the organ is affected, it retains its normal size. The skin is much disturbed, and the *nervous system* highly excited, the constitutional disorder is not inflammatory fever. Thus both the constitutional affections differ from mastitis. 2. The diagnosis of chronic mammary induration and *adenoid* growth, may be made only when the adenoid tumour is seated within the substance of the mammary gland, and not upon the organ,—as a distinct growth. The small, hard, granular, and circumscribed adenoid resembles the granular lump of chronic induration; and the collection of other such nodules would increase the resemblance. But the disappearance of chronic induration under palpation distinguishes it from the presence of a new growth. 3. *Cancer*-growth differs from the production of a *single tumour*—instead of having the character of induration-nodules; and thus the small, hard, circumscribed tumour of scirrhus cancer may be distinguished, or when the cancerous mass is a mass, in the diffused form.

The increased *size* of the mammary gland in consequence of *any* intra-mammary tumour, will also more or less contrast with chronic induration.

Causes of chronic mammary induration seem to have reference to general derangements of the *generative organs*, but which may be of opposite character; amenorrhœa, menorrhagia, dysmenorrhœa, or profuse leucorrhœa. It may also arise from *eczematous* or *irritation* of the nipple or areola. *Unmarried* women, *twenty-five* and *forty* years of *age*, are most subject to these; and of the married, *sterile* women are far more frequently

Treatment is chiefly *constitutional*; tonics, such as iron, quinine, the salts, and occasionally sedatives, have the most beneficial influence, with the hygienic regimen of *hysteria*. *Menstruation* may be regulated by remedies which directly regulate that function. Of applications, evaporating lotions and sedative ointments are of some use in relieving pain; and when the breast will bear pressure, rubbing, or with emplastrum ammoniaci cum hydrargyro, may aid in the induration.

Prognosis.—A condition of *hyperæsthesia* or exalted sensibility of the *skin* covering the breast, as well as the gland itself, is not an affection. The breast is somewhat enlarged, firm, and cervical.

age of twenty-five; and it seems induced by depraved habits.

The TREATMENT is similar to

Tumours.—(1.) **Adenoma**

This most common form of breast its section has a bluish or greyish on exposure to the air, and presents a thick yellowish-white fluid, color of this tumour closely resembles might therefore be termed a *pseudocyst* an encapsuled and therefore *discrete* as a new growth of gland-tissue.

Two *varieties* of structure may consist of more or less densely colored a milky secretion, and the growth. **CYSTIC** adenocoele, the cysts proliferate and containing a yellowish, transparent or dark and opaque. The quantity varies from a few ounces to several ounces. Here, the cyst is equivalent to adenoid growth. The cysts arise from the dilatation of lactiferous ducts. Adenocoele differ in their origin, and in their course.

SYMPTOMS.—Adenocoele commonly *circumscribed*, and *painless* or *slightly painful* upon the surface of the breast, and *situated* behind it. When *superficial*, the skin, being attached to the gland, is *imbedded* or *behind* the gland. With an increasing size of the growth. *More than one* such lump, or *multiple* size from half an inch to two

thin-walled cyst empty and collapsed. Cystic adenocoele is a cyst. The skin stretching over the tumour, usually accommodates increasing distension without ulceration ensuing; sometimes, the skin becomes inflamed, and sloughing, a *fungoid growth* externally, or a peculiar bleeding ulcer forms, the edges of which lie flat upon the intra-capsular growth, being neither inverted nor adherent thereto. The ulcer is very *indisposed to heal*; discharged the serous contents of the cyst, the opening may recur on several occasions, until, at last, the proliferous adenoid protrudes as a fungous mass.

—No age is exempt from adenocoele; it may commence about subsequently, and most frequently at the period of passive life of the breast, between *twenty* and *thirty* years of age; the cystic variety more often at a later period—from thirty to fifty. *Single* is most liable; and of married women, it occurs more often in those who have borne children, but rarely during pregnancy. *External* blows, is now and then, apparently, the exciting cause of

AND TERMINATIONS.—Adenocoele grows with a varying rate of increase. The originally solid and *fibrous* form enlarges *slowly*, as a chronic disease; the course of years, the *cystic* form increases more *rapidly*; the cystic variety may attain a large or even *enormous size*, and a weight of several pounds. The general health remains unimpaired, excepting when the growth reduces it by continued discharge. Sometimes the tumour is stationary, or enlarges with sudden rapidity, and occasionally recurs. After removal, it *seldom reappears*; the fibrous variety of the cystic variety less unfrequently; and youth confers a immunity to recurrence, no return having ever been met with, by which time the tumour had originated before thirty years of age. Adenocoele may alternate from fibrous to cystic, and a third time in the fibrous form of growth.

Diagnosis of adenoid tumour from other tumours of the breast is obtained by reference to the *whole* of its pathology; in respect to the patient, the characters of the tumour, and its vital career. In the characters of *syphilitic gummy mastitis*, and of *chronic inflammation* of the mammary gland, adenoid tumour has already been considered. The points of distinction between adenoid and *cancer* of the breast are important. They are mainly—that adenocoele occurs in youth or under thirty years old; the painless character of the tumour, even after handling, although at the catamenial period it may be painful, or in rare instances it may be the seat of neuralgic pain; the generally of any implication of surrounding parts by the tumour, the skin, with retraction of the nipple, and ulceration of the skin over the tumour, and never any enlargement of the neighbouring lymphatic glands; the general health also unimpaired. 3. *Cystic* adenocoele more apparently resembles cancer, particularly when the growth has advanced to the conical form, and it assumes—that of a protruding fungoid mass. But the absence of pain, of any contact with the skin, and of constitutional cachexia.

round or spindle cells, with perhaps some giant-cells, differ in characters. The tumour may be circumscribed or diffused, is usually seated upon the *surface* or the circumference of the latter, within the *substance* of the organ, and may contain cystic sarcoma. Of different consistence, the *circumscribed* form firm or *hard*; the *diffused* is *soft*, or perhaps somewhat *soft*. Their rate of *growth*, however, is even more significant; increasing rather *slowly*, the tumour remains of smaller size *soft*, and diffused, sarcoma grows *rapidly*, and thus often enormous bulk in a short period,—with probably some enlargement of subcutaneous veins of the breast. But both forms of mammary tumour are *painless*, and after handling remain quiescent large without tending to adhesion of the integument, and without affecting the lymphatic glands, and leading to any constitutional change.

DIAGNOSIS.—By their *painless* character, and by the absence of systemic infection, *hard* sarcoma of the breast may be distinguished from *breast cancer*; and *soft* sarcoma more especially diagnosed from *breast cancer*.

No period of life is free from the liability to mammary sarcoma; activity, however, seems to beget a tendency, as the disease is often in *married* women. But, the *harder* and slower-growing tumour of the breast—commencing perhaps during pregnancy—most frequently between *twenty* and *thirty* years of age; *soft* sarcoma, and of far more active growth, is most common at the decline of uterine life, in *mid-age*.

The TREATMENT of mammary sarcoma is none other than by the knife, and at the earliest period. *Recurrence* often to the disease may at length lose its reproductive power, removal; on the other hand, at a later period, the growth returns again and again, and may at length prove fatal.

(3.) **Cysts, and Cystic Tumours.**—Cysts—single or multiple or compound, and having various fluid or solid contents.

ducts, with which they may communicate, or appear as perfectly closed and independent cysts. Ultimately, a small ulcerated opening may take place, discharging the *serous fluid*; the cyst flattens and may disappear, or reopen. Serous cysts occur in women of middle age—in a passive state of the gland.

(b.) Sometimes, SANGUINEOUS CYSTS form in the mammary gland, containing blood, or changed into a reddish-brown, grumous fluid. Such cysts—Velpeau states—have been found completely isolated, or continuous with lactiferous ducts or with veins in the gland. They may have arisen from contusion of the breast.

(c.) DUCT CYSTS,—perfectly closed or communicating with a duct, and containing mucoid secretion; hence named also *mucous* cysts of the breast. The mucoid secretion sometimes oozes from the *nipple*, or may be pressed out of the cyst. The contents are characteristic; the mucus being thick and viscid, of a yellowish-green or brownish colour; or more fluid and having a reddish, brown, or even a black tint, from blood-staining. Thus, the cyst enlarging and becoming prominent, the colour of its contents is transmitted through the stretched integument, which appears *discoloured*, as if perhaps from inflammation. Ulceration ensuing, the mucoid matter is discharged. Several mucoid cysts often co-exist in the breast, and when of small size, are seated chiefly towards the *circumference* of the gland or deep in its substance. They are found commonly in women of about middle age, and especially in those who have borne children. But, single and barren women, who have never suckled, are liable to these cysts.

(d.) GALACTOCELE or MILK CYSTS,—produced by *dilatation* of a *lactiferous duct* or its sinus from obstruction, or by rupture of the duct, and escape of the milk into the surrounding connective tissue. As a cyst-formation incident to suckling, and occurring, therefore, only during the period of lactation, it is rather a rare affection. The little *lacteal* tumour—appearing sometimes as an *oblong, fluctuating tube, near the nipple*—may enlarge perceptibly every time the infant sucks, and thus increase rapidly; or it may remain almost stationary. The serum of the milk accumulated undergoes absorption, while the more solid fatty matter and earthy salts are deposited, causing the swelling to decrease, and become firmer or quite hard, unlike a cyst-wall; or the deposit may take the form of a *lacteal calculus*.

(e.) SEBACEOUS CYSTS are very rarely found within the *substance* of the mammary gland; but as the contents of such a cyst bear some resemblance to the inspissated milk of a galactocoele, the difference between these cyst-formations is worthy of notice. The *sebaceous matter* is a creamy fluid, of a yellowish or greyish-blue colour, with glistening white particles of cholesterine. It consists of fat globules, scaly epithelium, and some cholesterine. The cyst having originated in the cutaneous surface of the breast, must have deepened into the mammary gland, and may even get partly behind it.

(f.) HYDATID CYSTS are occasionally met with in the breast.

SYMPTOMS.—Certain characters are common to all cysts and cystic tumours in the breast. 1. A *single* cyst presents a globular tumour, having an elastic tension or fluctuation; more or less perceptible according to the superficial or deep situation of the cyst, and the thickness of its walls. 2. *Multiple* or compound cysts form an irregularly lobulated tumour, otherwise having the consistence of a single cyst. Cystic tumour resembles

either of these conditions, in proportion to the cystic nature of the tumour; but associated also with a solid mass, bedding or enclosing the cyst or cysts.

Cysts are not essentially painful; they may become tender owing to inflammatory action, or in nervous subjects. The skin is unaffected, excepting in the fungating tumour of proliferous cysts; and then the neighbouring lymphatic glands remain uncontaminated, and the general health is unimpaired by any cachectic blood-condition. By these two particulars at least, cysts and cystic tumours, in common with all other non-malignant growths, are distinguished from *Cancer*. In all doubtful cases, and many will be dubious, the diagnosis should be determined by an *exploring puncture* and examination of the exuded cyst-contents, before resorting to any curative operation. Hydatid cysts are distinguished by the presence of *echinococci*.

TREATMENT.—*Absorption* of the contents of a cyst can sometimes be effected by the mere application of stimulating embrocations. On the same principle, iodine paint or blistering may be curative. *Puncturing* the cyst, followed by pressure, may obliterate the cavity by adhesive inflammation; or the introduction of a tent of lint will induce suppuration, and granulation from the bottom. *Excision*, by carefully dissecting out the cyst, is not unfrequently the best or only method of treatment; or it may be necessary to remove the gland, partially or wholly. Partial excision of the gland is apt to favour a recurrence of the cystic growth, in the remaining portion of the organ; but its entire removal is occasionally succeeded by cystic disease, or perhaps a cancerous affection of the cicatrix. Hydatid cysts, when completely extirpated, are not apt to return.

(4.) **Cancer.**—The breast is peculiarly liable to be the seat of primary cancer: scirrhus, very commonly; encephaloid, occasionally; colloid, rarely.

The disease appears either in the form of an infiltrating growth, or as a circumscribed or tuberos growth; or, it may be cystiform, associated with a cyst or cysts.

1. **SCIRRHUS.**—This species of Cancer may appear in the form of an intra-mammary tumour, or as infiltrating the whole organ, or upon its surface or circumference; or as affecting the nipple, or the skin.

(1.) Commencing, commonly, as a *circumscribed* tumour, or *lump*, of small size, about that of a Spanish nut, *hard* and *movable*; it occasions little or no pain, and may remain unnoticed, or is discovered by the patient, perchance, in washing her bosom or in dressing. It is seated usually in the axillary aspect of the gland; and the left breast is more often affected. *Increasing* in size *slowly*, this nodule acquires a *granular* or finely and sharply tuberculated character,—feeling knotty; and it gradually becomes more and more *fixed*,—not moving, or rolling, freely under the finger, as the nodule is seated within the substance or lies on the surface of the gland. From the remarkable hardness of the nodule, in this more advanced state it is aptly named scirrhus, and is popularly called "*stone-cancer*." An *intra-mammary* tumour displacing the surrounding gland-tissue, its development is attended with a proportionate *enlargement* of the organ, more visible in a thin-breasted woman. In an advanced stage of circumscribed cancer-growth, the unaffected portion of the gland may become *atrophied*, and thus the organ is reduced in size; the breast—containing this tumour—being perhaps smaller than that on the opposite side.

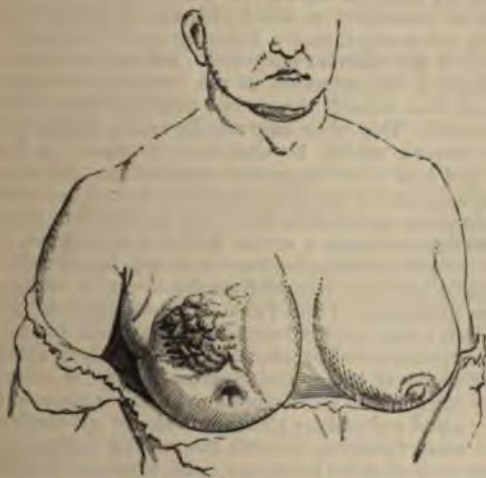
(2.) Scirrhus *infiltration* of the gland commences as a *diffused* mass, and

of a somewhat square shape; hard and irregular, and less movable deep seated than when superficial. The progressive infiltration of gland-tissue may be unattended with any marked enlargement of the breast, especially when the interstitially diffused mass is central and of small extent. Ultimately, *contraction* supersedes the infiltration, the breast becomes reduced in size, and the cancerous portion shrinks into a hard lump,—like circumscribed or tuberiform scirrhus.

Cysts are liable to form in connection with the scirrhus growth, constituting a cystic cancerous tumour; which is thus rendered more *globularly lobulated*, and *partly solid, partly fluctuating* more or less perceptibly, under pressure with the fingers.

The *surrounding parts* become involved, and generally the tumour is the seat of *pain*, perhaps severe; and which is variously described by

FIG. 106.*



as dull and aching, shooting or stabbing, burning, etc. These express the different kind and degree of pain experienced as the disease progresses to ulceration; the burning or scalding sensation superadded after the lancinating or the heavy pains in the earlier stage of the disease. But usually during the first year, at least, scirrhus cancer of the breast is painless, except perhaps there may be slight twinges occasionally after handling the tumour; subsequently the pain—having the foregoing characters mentioned—is aggravated in proportion to the rapidity of growth, or during any attack of inflammation or sloughing. The gland resists *adhesion* to the pectoral muscle, and to the skin over the tumour; integument gets bound down with some dimpling or puckering (Fig. 106) and acquires a brawny character, a reddish or greyish tint, and a dull or greasy look, with the *pores enlarged*—a very diagnostic appearance.

* Royal Free Hospital. (Author.)

ance; the nipple is often drawn in by the adherent and contracting gland—presenting the appearance of *retracted nipple*. It betokens the infiltrating or diffused form of scirrhus, and especially when central in the gland. (See Fig. 106.) But this condition is not peculiar to cancer. Sometimes, the nipple having been retracted, becomes more prominent and fuller than before, as the result of progressive infiltration, invading the nipple. A *sanguinous discharge* from the nipple occurs in some cases, and as an early symptom, when the lactiferous ducts are involved; but this, as well as retraction of the nipple, is not pathognomonic of cancer-growth in the gland. Other significant changes ensue. Reddish-brown discolouration of the integument, at some tightly adherent part, is followed by the formation of a crack or fissure, which scabs over, while ulceration proceeds underneath the scab. *Scirrhus ulcer* is at length formed, having the ordinary characteristic appearances; hard, thickened, and everted edges, around an irregular chasm, the surface of which has a greyish-green colour, or sometimes a violet tint, and discharges foul purulent matter, having the peculiar, musty, sickening smell of cancer. Or, instead of commencing in the adherent integument, and getting deeper, ulceration may rarely begin in the substance of the tumour, by softening and disintegration, and thus come to the surface with discharge. In either way, an ulcer is formed. This ulcer may remain nearly stationary for months or years; or increase rapidly by sloughing; or throw up large fungous granulations and heal by an imperfect cicatrization. Sometimes, ulceration having commenced in the integument, the cancer, instead of perishing as the ulcer deepens, continues to grow, and protrudes to some extent, as a hard fungoid mass, exuding a serous fluid or a sanious pus, of cancerous odour. The ordinary appearances may be varied, occasionally, by attacks of acute inflammation, hæmorrhages from the ulcerating surface, or œdema consequent on obstruction of the veins or the lymphatics. The *axillary lymphatic glands* sooner or later become enlarged and indurated, or assume the form of an agglomerated bunch, adhesion takes place, and they undergo the further course of breast-cancer—more rapidly, in some cases, than the mammary tumour. In an advanced and extreme state of the disease, the mammary gland and axillary glands form almost one continuous matted and adherent mass, extending through the cellular texture and the lymphatics; while the skin of the breast and axilla, or around the chest, presents a sort of coriaceous, thick, reddish, leathery cuirass—the cancer *en cuirasse* of French authors—and which is accompanied with much œdema of the arm. The supra-clavicular and cervical glands may also be implicated.

During the course of the disease, constitutional *cachexia* sets in, usually, when the cancer begins to acquire adhesions, particularly to the skin; and both the local and the constitutional infection then proceed almost pari passu.

The deeper parts, and remote organs, may ultimately become the seat of *secondary cancer*. The ribs and intercostal muscles are affected more by the direct infiltration of cancer, giving rise to pleurisy, dyspnoea, and hydrothorax; but cancer may appear in the lungs, or in the bones, and result in fracture, or in the liver or uterus, and possibly escape detection during life. Exhaustion, consequent on prolonged discharge and the constitutional infection, is perhaps the most frequent cause of death, in about *three to four years*; life being extended to a far longer period of ten years or more, in old women or with quiescent scirrhus.

3.) Scirrhus commencing in the *skin* of the breast, appears in the nipple, as a tubercle, situated usually towards the axillary border of the breast. Advancing inwards to the gland, the course of the disease is the same, but probably will have a more restricted range. Commencing as a marbling or mottling of the *skin* over the breast or chest, of a greyish or yellow-red tinge, it might seem to be the common cutaneous exanthem of syphilis; but the discolouration gets fixed—not disappearing under pressure, and the patches of skin become *hardened* and *thickened*, forming plates, sometimes raised or depressed and retracted, of increasing extent, which coalesce, and may form a *cuirass*. The respiration is greatly embarrassed by this rigid breastplate, and as the usual stabbing, burning, or other pain of cancer sets in, the patient's sufferings are excruciating. At length, softened *ulceration* takes place at various points, followed perhaps by the growth of scirrhus nodules around the ulcers, and death ensues, both from asphyxia and exhaustion. Velpeau often met with the diffused form of mammary scirrhus consequent on the *deepening* infiltration of this elementary scirrhus.

In rare instances, scirrhus of the breast undergoes arrest of development, and the tumour withers or becomes *atrophied*; and sometimes an advanced cancer may cicatrize and *remain healed*. But it is extremely doubtful whether there is a single instance of permanent recovery.

Breast cancer is occasionally *bilateral*; but the disease is always consecutive in the two organs; and both cancer-growths may be connected by enlarged lymphatics, or a chain of small cutaneous scirrhi.

ENCEPHALOID begins either in the substance of the gland, or occasionally in the immediate neighbourhood. It appears as a *circumscribed*, hard tumour, of soft consistence, rather largely *lobulated*, or feeling like a *glomeration* of small, softish balls, and *rapidly increasing* in size. The skin is distended before the enlarging growth, and does not so readily become adherent, but presents a largely open *network of veins*.

By its physical characters, the tumour might be *mistaken* for compound cancer; in that case, however, the skin retains a passive appearance. Sometimes the integument soon becomes inflamed and œdematous, and then the tumour simulates the characters of an abscess. But, in the course of encephaloid growth, cysts are liable to form, and abscess is apt to occur.

At first painless, and perhaps not even uneasy after handling, encephaloid growth never acquires the painful character of scirrhus, previous to ulceration. The cancerous gland is less disposed to contract deep adhesion, to the pectoral muscle, or with the overlying integument; the skin is stretched and shining, traversed by large veins; and there is no retraction of the nipple. As the tumour *advances*, its *consistence* varies in different parts; one nodular lump being firmer or lardaceous, another is softer and more elastic, while others are soft and fluctuating. Softer portions grow with the greatest rapidity; and thus the tumour attains the size of a fist in three months, and ultimately that of a child's head or that of an adult. But the breast rapidly acquires a remarkable *change of form*, becoming roundly prominent or *conical* at some part; and the overlying portion of integument getting *adherent*, assumes a purple hue, and forms a *circular ulcer*, through which the encephaloid growth issues as a *soft fungoid mass*, of a greyish or bloody colour, accompanied by a foul, purulent, and bloody discharge. This stage of ulceration with

protrusion commences about the ninth month of encephaloid growth; and at the same time, more severe and constant pain sets in. Portions of the mass disintegrating and separating, further protrusion from within takes place, and still maintains the fungous out-growth, overhanging the integument. Rarely, the whole tumour thus sloughs out, and cicatrization results. Otherwise, after the detachment of mushroom-like projections, some of which may be as large as the fist, the encephaloid ulcer which remains presents a deep excavation, of an irregular shape; the border is thick, round and everted, somewhat indurated, and has a red or livid colour. From the cavity there issues an ichorous or bloody purulent, fetid discharge; varied by attacks of copious hæmorrhage. Bleeding fungoid growths sprout from the surface and border of this ulcer, and it extends rapidly, mostly by further excavation beneath its circumference. The *lymphatic glands* are involved, although less readily than in scirrhus of the breast; but then they enlarge, soften, and ulcerate, more rapidly, like the mammary encephaloid tumour; yet the constitutional *cachexia* is less marked, or absent.

In the course of ulcerative destruction of the tumour, with constant discharge and suffering, and repeated loss of blood, the patient's health and strength decline. *Death* occurs sometimes from hæmorrhage, but commonly ensues from exhaustion, in a period averaging from six to twelve months; the tumour growing most rapidly in *young* and healthy women. Sometimes, the fatal termination is hastened by an attack of *pneumonia* or *pneumonia*, or by the supervention of hydrothorax, with perhaps pulmonary oedema. After death, *secondary* encephaloid growths may be found, usually in the lungs or liver.

3. COLLOID.—This rare kind of cancer of the breast, consisting of gelatinous substance, loculated by a delicate fibrous matrix, forms a tumour of a somewhat *tense* and *elastic* character,—not very distinctive. Assuming that colloid is a species of cancer, there can be no doubt of its production occasionally in the mammary gland. Isolated centres of the growth are disseminated freely around the principal mass, an important pathological condition with reference to the operation of excision for complete removal of the tumour. This kind of cancer is usually associated with scirrhus or encephaloid.

DIAGNOSIS.—In examining any Tumour of the Breast, its nature can be determined only by following the general rule of diagnosis—that, while no single sign or symptom, local or constitutional, will be sufficiently distinctive, the *combination* of signs, whether as co-existing or consecutive, will supply that concurring evidence, by which the diagnosis may be established.

Thus, if a hard and movable tumour or nodule, of granular or finely lobulated character, be found in the breast; if it be painless perhaps, but becomes painful soon after handling; and if this lump has formed in the breast of a woman from thirty to fifty years of age, without probably any apparent cause, and has remained, stationary perhaps, for a period of six months or a year; this combination of evidence will indicate the *probably cancerous* nature of the mammary tumour. If, in the course of a longer or shorter period, this tumour contracts adhesion with the superjacent integument, and which has become indurated over some prominent part, the nipple of the breast becoming retracted, and from which there ensues, perhaps, a bloody sanious discharge; if the adherent portion of skin gets

red, and at length, cracking or sloughing, forms an ulcer of an open character; if, during these superficial changes, the tumour becomes more fixed and fused in the gland-substance; if it be now painful, or less constantly, the pain having a variable character, dull and lancinating, or burning; if, sooner or later, the axillary lymphatic or perhaps the supra-clavicular and cervical glands, get hard and enlarged, and the patient manifests some constitutional cachexia; then, additional evidence will render the probably cancerous nature of the primary tumour positively certain. The removal of a cancer-growth, from the breast, is often followed by its recurrence—in the primary or in the axillary glands, or by the development of secondary cancer in some distant and internal organ—in the bones, perhaps the subcutaneous tissues, in the lungs, liver, or uterus.

In all the signs or symptoms of cancer-growth may not be present in one case, or at the same time; on the other hand, other tumours or diseases of the breast may have one or more of the characters of cancer, and thus we are led to institute a comparison, in order to distinguish between them.

With regard to diseases of the breast, of an inflammatory nature, the resemblance of a cancer-tumour to the swelling from mastitis, in any case, is counterbalanced by the difference of these diseases in so many other characters, as to render an error of diagnosis almost impossible. Every ground of comparison there may be, could be only in connection with the phlegmonous or phlegmonous mastitis (p. 570). The diagnosis between chronic inflammatory and cancer-tumour has been already noticed more particularly in connection with the former affection. Chronic induration of the mamma in an inflammatory affection—was also compared with cancer-tumour.

Proceeding further in our diagnostic analysis, the distinctive characters of cancer and other tumours of the breast are most important. Some tumours are non-malignant; others are recurrent, and bordering on a malignant nature.

The differentiation of cancer from non-malignant tumours of the breast, no general characters can be formulated, which shall guide the physician in forming a correct judgment.

The question of diagnosis relates principally to adenoid and cystic tumours, and at a sufficiently early stage of growth; for whereas an adenoid tumour, for example, may be removed by operation, without recurrence, cancer can be extirpated only at an early period, with a fair chance of cure.

The tumours of adenoid and scirrhus cancer are alike,—a small, movable nodule or lump, seated in, or on, the mammary gland; each having a granular or finely lobulated character. The diffused condition of cancer is materially the same as that of the circumscribed, nodular cancer. But the physical characters of the tumour should be supplemented by taking into account its vital nature as a growth. Cancer may be painful certainly becomes so when provoked by manipulation; it will grow more rapidly to its present size, and has occurred probably at an early age—between thirty and fifty years of age; adenoma is painless, grows slowly, and will be found in the breast of a young woman under twenty years old, or of a girl soon after puberty.

The tumour of encephaloid cancer resembles that of a cystic

adenoid, or other *cystic* tumour, in its nodular and lobulated chara globular form, and soft or elastic consistence; but the enlarged *ramiform subcutaneous veins* over an encephaloid growth in the breast contrast with the passive appearance of the skin covering a cystic tumour—not itself cancerous. Failing thus to recognize their distinction, recourse to *puncture* will determine the balance of evidence.

At a *later stage*, both scirrhus and encephaloid cancer will have undergone the changes of integumental adhesion and ulceration, peculiar appearances of which, coupled with lymphatic involvement, constitutional cachexia, will distinguish cancer-growth from the changes incident to any non-malignant cystic tumour.

Other non-malignant tumours, of very exceptional occurrence in the breast, require no special notice here. Such are the *Fibrous* and *Nodular* tumours; *Fatty* tumour; and *Enchondroma* or cartilaginous tumour in the mamma.

3. Passing on to *Sarcomatous* tumours; it is difficult to draw definite features of distinction between Cancer and these growths, in the breast. But this difficulty is experienced only as relating to the *early stage* of Sarcoma. The hard and soft forms of Sarcoma resemble Scirrhus and Encephaloid, respectively, in regard to their consistence. The former also attains to a smaller size, and by slower growth; while the latter is apt to acquire enormous bulk, and by the inherent rapidity of its growth accompanied perhaps with some enlargement of the subcutaneous veins thus more nearly resembling in appearance a mass of encephaloid cancer. But both forms of sarcoma are *painless*—the main point of difference.

At a *later stage*, the nature of a cancer-tumour is declared, by its invading the integument, and the formation of an intractable ulcer, with specific characters, by lymphatic dissemination, and constitutional infection. By the *absence* of these additional changes, sarcomatous tumours may be recognized.

It is scarcely necessary, for any practical purpose, to pursue the diagnosis of mammary cancer further. Having arrived at the conclusion that the tumour is *cancerous* or of a malignant nature, and not benign, even sarcomatous, the Surgeon is not concerned to enter into a critical comparison of scirrhus and encephaloid. The characters of both forms of cancer-growth in the breast have been fully described.

CAUSES.—The *causative relation* of age and *uterine activity* to the occurrence of the breast is an important question, respecting which certain general facts may be gathered from large collections of cases. From the fortieth to the fiftieth year, or the *fifth decade* of life, is the age most subject to this disease, as affecting the breast.

Unmarried women are said to be more prone to cancer of the breast than the married, and sterile women rather than those who are prolific. The *fallacy* of these notions is shown by Birkett by an analysis of 100 cases; 86 were *married*, and 14 only single. Of the 86 married women 73 were *prolific*, 4 had aborted, and 9 only were sterile. In relation to *lactation*, there does not seem to be any marked connection between the imperfect performance of this function and the subsequent development of cancer; and it is a notable fact that the disease is very *rarely* developed during *pregnancy* or *suckling*. The function of menstruation is usually persistent, at the time of life when the disease more often occurs.

Hereditary predisposition does not seem to have much influence in the production of breast-cancer. From collections of cases by Paget and Lebert, it appears that about one in six may be referable to some hereditary tendency. The *general health* at the commencement of the disease is apparently good in the great majority of cases; and it is uncertain how far any causative influence can be attributed to depressive mental conditions, such as grief, or to temperament or occupation.

The *origin* of the disease is popularly attributed to some external injury, as a blow, or the pressure of a stay-bone; there is abundant evidence to justify this belief, and that any injury to the breast, however slight in itself, may be the exciting cause of cancer-production—in about one in six cases.

ECZEMA of the NIPPLE and AREOLA sometimes precedes cancer of the breast, apparently in the relation of cause and effect. Usually, however, there is no continuity of diseased texture between the integumental eruption or superficial ulceration of the areola, and the subjacent glandular cancer-growth,—a clear interval of apparently healthy texture lying between the two; although, in some cases, a direct communication can be traced by microscopic examination, the galactophorous ducts being affected. *Epithelioma*, in the form of intra-mammary nodules, is the species of cancer-growth usually induced by the chronic cutaneous inflammation. The *period* which *precedes* the development of the mammary disease varies from one to two years; even four or five years may have intervened during which the areolar eczema had continued alone. The *age* of the patient has also varied from thirty to between forty and sixty years. Eczema of the nipple is, however, a *rare* precursor of, and may not be followed by, cancer in the mammary gland.

TREATMENT.—The *hygienic* and *medicinal* treatment of cancer of the breast, and its *removal* by *operation*, whether by excision or some other method, are two principles of treatment; each of which has its advocates, and to the exclusion of the other and opposite principle.

The truth, as in many other matters, lies between these two extreme rules of treatment. The intermediate plan has reference to the individual case, both with regard to the local condition of the cancer and the constitutional power of the patient.

(1.) Assuming a case to be thus *ineligible* for operation, the following plan of treatment should be pursued. A generally *nutritious diet*, as the phrase goes, will suggest the object to be attained, in the selection of dietetic resources; but it is absolutely necessary to watch and discover, in each case, what particular articles of diet are most suitable for the improvement of the patient's general nutrition, and may have any marked influence on the progress of the disease. *Anodynes*, applied topically and administered internally, not only relieve the often severe and prolonged suffering incident to this disease; but these medicinal agents are important adjuncts to our dietetic resources, in procuring sleep and repose of the nervous system, requisite for a more healthy nutrition. Thus, narcotics, and in particular the preparations of opium, are highly advantageous; while conium ointment is, I think, the most soothing topical anodyne, although aconitine ointment or belladonna plaster may be equally so in some cases. The preparations of ether—sulphuric and chloric—and chlorodyne, are most efficacious for the relief of *paroxysmal* pains of a neuralgic character; and

to its varying conditions. *Sloughing* should be met by p cleansing lotions of chloride of zinc, permanganate of potash acid; in conjunction with sedatives, such as morphia, conia donna, to allay pain. *Hæmorrhage* may be restrained by temporarily applied, or by means of astringent powders or lot tannin or tincture of the perchloride of iron. *Edema* of the advanced stage of the disease, can be somewhat relieved by bandaging and elevation of the limb.

(2.) CONDITIONS FAVOURABLE FOR OPERATION.—In purely local and isolated condition of the cancer, its removal is favourable—in relation to the prolongation of life. This local with it a commensurate share of constitutional power. In the *early stage* of cancer, when it is as yet small and movable, adhesions or implications of surrounding parts—either in the by adhesion, whether in the form of brawny induration, dimples marked retraction of the nipple, or ulceration, or implication of the glands by enlargement and induration—and consequently with little or no constitutional cachexia, the breast may be removed with a favourable prospect of prolonging life. Scirrhus tumour seated in the mammary gland, or affecting only the nipple, may be removed by a free excision.

CONDITIONS UNFAVOURABLE FOR OPERATION.—The following rules represent the conditions, local and constitutional, wherein operation of advantage is clearly *against operation*. Any *diffused form* of cancer is a very unfavourable condition for removal, compared with a circumscribed form, as a tumour within the gland. In well-marked cancers, especially in old persons, the probability that operation will prolong to either the comfort or the length of life is so little, that it is better not be incurred. In cases where the *cachexia* or constitutional disease is more than proportionate to the local disease, operation would too probably be fatal, in its own consequent

e; recurrence taking place generally as soon after early as after operations.

PROBABILITY OF PROLONGING LIFE BY OPERATION.—This is the element in favour of operation; life is prolonged for a period ten to twenty months—or more than a *year and a half*, by of the cancerous breast. But the *period of the disease*, when to operation, makes a very important difference in its result. the *first two years* of the disease, the proportion of deaths has d to be much less in those operated on than in those who were cure and other treatment; being in the former less than eleven in the latter more than thirty per cent. The *temporary relief* ring should, however, always be taken into account in consider- visability of operation; and that the progress of the more rapid started by operation.

rrrent Cancer of the Breast.—Cancer may return in the and subsequently implicate the glands; or in the *glands* without ous affection of the cicatrix. As *secondary* cancer, the disease pear in some internal organ,—the lungs, bones, liver, or uterus. ely, the disease returns in the opposite breast. The *species* of growth, in any situation, is almost always the same as the cancer,—scirrhus. *Cicatricial* scirrhus is a tubercular growth. ring as seed-like bodies, seated at the edge of the line of cicatrix tting the surrounding integument, they are hard and slightly t, feeling like hemp or caraway seeds imbedded in the skin. s and scarcely tender, these incipient tubercles assume a pale-red d then a purplish hue, and become painful. Slowly increasing o that of a hazel-nut or larger, they form scattered prominent or *buttons* of cancer-growth—presenting a very characteristic ce. Sometimes, the seed-like bodies lie evidently beneath the are more movable as subcutaneous formations; and similar cancer-growth may occur in any portion of the gland itself, ay have remained after an incomplete operation of removal,— in the form of disseminated granules, or having a nestled ent in the bit of gland-tissue. The *period of return* is uncertain; s before cicatrization is completed, and having the characters of us ulcer; or not until after some weeks or months of completed on, then having the *tubercular* form in and around the *cicatrix*, nodular growths undergoing cancerous ulceration. Recurrent ay, or may not, run its course more rapidly than the original ut it is said to be less painful and exhaustive.

peration of excision is still justifiable, even to the third or fourth nce of a cancer, in order to relieve suffering; provided the con- l power of the patient seem sufficient to sustain life. When of internal secondary cancer have supervened, it will be useless puate the locally recurrent growth, whether for the temporary affering or to prolong life.

ation of Amputation of the Breast.—Whatever may be the hether a cancerous or non-malignant tumour, removal of the performed in the following manner:—The patient lying down, form having been administered, an assistant holds the arm away affected breast, sufficiently to put the pectoralis muscle on the



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107). Care should be taken not to make a button-hole blemish which may be avoided by directing the edge of the the tumour, in detaching it from the integument, below and

A *cancerous* breast must be removed more extensively the seat of non-malignant tumour. The incisions should be to include any apparently affected portion of integument; upwards towards the axilla when necessary, to allow the removal of the *affected glands*. In removing the tumour, the dissection should be wide of the disease and fairly into sound tissue around, in order to completely extirpate the diseased mass. It may be more convenient, concluding the operation, to extend the axillary junction of the incision to reach any diseased glands; their connection with the breast may then be left to the Surgeon to drag them out of the axilla, when they are

and to enable the operator to see his way in applying the knife, the tumour is unusually large and vascular. At the same time, the an artery should be compressed by an assistant. If the tumour be non-malignant, only one or two vessels may have to be secured; if of a malignant tumour will probably necessitate the ligature or of numerous and large-sized arterial branches, which are supplied more active form of growth; and venous hæmorrhage may require

Cold ablation will generally arrest any oozing hæmorrhage, arterial or venous. On bringing the arm to the side, the integument over the pectoral region becomes relaxed. The *lips* of the wound can then be brought together by points of fine wire suture; if a large portion of integument has been excised, it will be desirable to pass three or four *deep* wire sutures, supported by *buttons*, thus to relieve the lips of the wound from any strain of the superficial sutures; and the support of two or three long strips of lint with a *compress* of lint and a broad bandage carried around the chest will prevent any subcutaneous hæmorrhage and bagging in the loose integument. It may be advisable to secure the arm to the side of the chest, by additional turns of the bandage, lest any restless movement should disturb the wound. Primary union usually takes place, and in a few days; sometimes this union is spurious, and the wound opens up partially at the site of suppuration, and heals by granulation. Then, if there be some tendency to the bagging of matter, a piece of *drainage-tube* should be introduced into the lower angle of the wound, rather than make a counter-opening. It may be deemed necessary to remove the breast with *antiseptic* precautions, and drainage should be provided with the primary dressing. *Secondary* hæmorrhage may necessitate a reopening of the wound, and the application of a dressing. When the patient gets up, the arm should be supported in a sling, while the breast-cicatrix, as yet tender, would be strained by the weight or movement of the limb. Eventually a sound, puckered cicatrix is formed; or perhaps a recurrent form of growth, when the original tumour was malignant.

The risk to life, from the *mortality* of the operation itself, does not exceed 5 per cent.

THE ABDOMEN.

CHAPTER XLVI.

INJURIES OF ABDOMINAL PARIETES, AND VISCERA.

Injuries of the Abdomen are of almost equal concern to the Civil and Military Surgeon. Their leading practical distinctions are as follow.

Contusion of the Abdominal Parietes.—The extent of structural injury produced by contusion varies considerably; the abdominal wall being lacerated possibly, while the skin remains unbroken. The appearances of Bruise are presented, in most cases, and the usual

symptoms of Shock in a greater or less degree. Other symptoms have a variable significance. A *tympanitic* state of the abdomen may arise from shock,—inducing a paralytic condition of the intestines; but, if persistent, tympanites probably denotes some organic lesion. *Peritonitis* may result from contusion with, or without, visceral complication; but, in the one case, the peritoneal inflammation is general, in the other usually local,—under the seat of the abdominal bruise. *Vomiting* affords doubtful evidence of internal injury. *Retention of urine* is also an equivocal symptom, being due to shock or to rupture of the bladder. *Suppression* or arrested secretion of urine occurs in some cases of abdominal contusion.

The CAUSE of contusion may be various occasions of external violence—such as a blow or kick, or gunshot injury. After recovery, the abdominal wall sometimes becomes *atrophied* at the seat of injury, predisposing to the occurrence of ventral hernia. *Rupture* of the abdominal muscles is sometimes produced in the same way as contusion; or occasionally by violent straining efforts, or the force of tetanic spasm. An *interval* between the retracted portions can be plainly felt, in the abdominal wall, unless obscured by fat, and after the subsidence of any temporary swelling.

The TREATMENT has reference to the recovery from Shock, by a moderate administration of stimulants; followed by the ordinary topical applications to a bruised part, coupled with rest. The contingencies, inflammation and its consequences, or hernia, occurring with or consequent on the abdominal contusion, must be treated in accordance with these conditions.

Injuries implicating the Abdominal Viscera.—The GENERAL SYMPTOMS of any such injury are those of Shock—severe and prolonged, coupled with the Collapse arising from internal hæmorrhage. The pallidity of countenance and anxious expression, the coldness of surface, and thready, feeble pulse, are sufficiently significant symptoms. Constant restlessness—the patient throwing his arms to and fro on his pillow, and craving for drink to appease an insatiable thirst, would indicate the predominance of collapse—from internal hæmorrhage, in conjunction with the nervous shock. The temperature falls, perhaps equally, in either state of the body, and is, therefore, not diagnostic. With *extensive internal hæmorrhage* there may be some swelling, with perceptible dulness on percussion, and pain,—over some particular part of the abdomen, thus indicating the *seat* of injury. Tympanites often supervenes. Bloody urine will point to the kidney, or the bladder, as the source of hæmorrhage. But the state of nervous shock may so mask the syncope or faintness arising from the internal loss of blood, as to render it impossible, for the first few days, to decide whether there be any visceral lesions.

In the immediate *treatment* of abdominal injury, this uncertainty as to its nature will suggest the moderate and watchful use of stimulants.

The CAUSES of injuries to the abdominal viscera are rupture from contusion, and penetrating wounds of the abdomen. *Contusion* producing visceral *rupture*, is necessarily occasioned by severe external violence; the passage of a cart-wheel over the abdomen, or compression between the buffers of two railway carriages, known as Buffer-accidents; and in Military practice, the brushing action of a so-called wind-contusion, or the direct pounding of a spent cannon-ball. Rupture of any one of the viscera, and extensive internal hæmorrhage, are not necessarily attended with any mark of contusion or bruise, as an outward sign of this internal injury. As

abundant layer of fat in the abdominal wall, combined with thick clothing, seems to form a buffer of yielding resistance, which may prevent the production of a bruise. *Penetrating Wounds* and involving the viscera, are commonly produced by a stab or a pitchfork accident; and in Military practice, by a sword-cut, or bayonet-thrust, a bullet, or other gunshot injury.

RUPTURE, OR PENETRATING WOUND, OF DIFFERENT VISCERA.—DIAGNOSIS.—(1.) *The Stomach.*—The diagnostic symptoms are vomiting of blood, with, perhaps, the escape of some of the contents of the stomach in the case of a wound. But the stomach has been ruptured, almost completely across near the pylorus, and no blood appeared in the vomited matters. The situation and depth of a wound will help to determine the diagnosis.

(2.) *The Bowels.*—Similar symptoms are diagnostic; the passage of blood in the stools, and the escape of *fecal matter* through a wound. Sometimes the intestinal contents can be found on the penetrating instrument. *Extravasation* of fecal matter into the abdominal cavity is attended with instant excruciating pain, radiating over the whole abdomen from the seat of injury, and extreme collapse—from *peritonitis*. But a small puncture or an incised wound of the intestine, under three lines in extent, or as thus diminished by muscular contraction, may not allow of extravasation; the mucous membrane protruding through the muscular coat and occluding the aperture, while the equable pressure of the abdominal viscera against each other further prevents any escape from an intervening wound. A *lacerated* wound of larger size may be also unattended with fecal extravasation, the peristaltic action of the intestine being deadened. In any case, the speedy effusion of plastic lymph tends to close the aperture. The absence of the characteristic pain and collapse, as symptoms of feculent extravasation, is, therefore, no conclusive evidence that the bowel is neither ruptured nor wounded. *Emphysema* of the abdominal wall may arise from the escape of flatus through an intestinal aperture, into the subperitoneal cellular tissue. Commencing, usually, in one or the other flank, the peculiar, pitting, crepitating swelling extends forwards around the abdominal parietes, and upwards towards the axilla. This symptom is the result alike of rupture or wound. In rare instances, feculent matter, or food, extravasated from the intestine or the stomach, has become encysted, and leading to the formation of *abscess*, has been safely discharged externally. A *ball* which has lodged in the abdomen may be discharged per anum. When this happens soon after the wound, it is probable that the ball directly penetrated the intestinal canal; but as occurring some time after the injury, the ball has probably entered the canal through ulceration, or by the communication of an abscess where the foreign body had lodged outside the intestines.

(3.) *The Kidneys* are sometimes ruptured or wounded. Frequent micturition of *bloody urine* is the diagnostic symptom; although the secretion of urine may be suppressed by complete structural disorganization of the kidney, and thus the absence of this symptom is no assurance that the kidney is uninjured. The escape of urine through a wound will at once indicate the nature of this injury. Any injury to the kidney is apt to induce *nephritis*; and when the peritoneum is implicated, urine escaping into that cavity, the case becomes almost hopeless from intense *peritonitis*. Otherwise, lesions of the kidney are not irrecoverable. Extravasation of blood into the loose cellular texture around the kidney may occur, without

to be followed by Peritonitis. Penetrating Wounds of the abdomen have also this liability. But if implicating the stomach or particular, the risk is greater; and if attended with the escape of contents of these viscera into the peritoneal cavity, the danger is maximum. On the other hand, all such injuries have a not unfavourable tendency to reparation, by primary union, and without the extravasation of blood or other matter.

TREATMENT.—*Rupture of any abdominal Viscus*—without the *abdominal wall*—suggests only two indications of treatment: the restoration from collapse; and the restriction of extravasation of blood or feculent matter, in order to prevent the suppurative Peritonitis. The one indication may be fulfilled by a judicious use of *stimulants*, with other measures to induce reaction; the other perhaps be accomplished by *rest* and *sedatives*. Opium in grain, or the liquor opii sedativus, should be given every four hours, and the patient under its influence; hydrocyanic acid and potash may be given to relieve sickness; while the diet must be restricted to spoonfuls of gruel with barley-water and ice, and no aperient medicine given for several days. A mild enema of gruel and castor oil will then be advisable.

Penetrating Wound of the Abdomen, not involving any Viscus—should be closed in the ordinary manner of a wound in a loose and supple integument. A few points of suture must be introduced to steady the divided integument in apposition, aided by a suitable position of the patient. A few points of suture must be introduced to steady the divided abdominal muscles; but the precaution of a compress and bandage is requisite as a support, to prevent the risk of visceral protrusion. The liability which has led to the more recent use of quilled and twisted sutures, for the deeper coaptation of the divided muscles, in a *gunshot wound*, the presence of a *foreign body*, as a ball, portion of bone, may allow of a superficial examination with a probe, in order to remove it from the wound; but no deep dissection should ever be made, with the view of extracting any foreign

ordinary *hæmostatics*; rest, astringents, and the efficacy of topical influence of cold, by means of an ice-bag. *Venesection* still practised by French and German Surgeons of large repute, with whom I concur, is denounced by men of equal authority in America,—as testified by their practice in the War of the

If any *Viscus*, commonly a portion of intestine or omentum, is protruded, before signs of strangulation have supervened, the reduction of the abdominal muscles, by position and gentle pressure, is the rule to be observed. A pedunculated *conprotruded* mass may be overcome by slightly enlarging the wound with a probe-pointed bistoury or hernia-knife. If *adhesions* have formed, they may be detached, when recent and slight; but when firm they had better be left alone, rather than endanger the intestine by a forcible separation or cutting division; and the Surgeon should be content with relieving the constriction,—thus conforming to the rule in regard to this complication, in the operation for strangulated hernia. In reducing the part, the direction of pressure should be towards the aperture through the wound; lest, otherwise, the protrusion be driven between the muscles, leaving the neck unreduced. Having reduced the part into the abdomen, the finger should not follow it, but the omentum may remain more safely placed near the wound. In the event of sloughing there shall be a free vent for the escape of the contents. An *inflamed* state of the protrusion does not contra-indicate the operation. If *gangrene* of the *intestine* must be treated on a different principle, to discharge the contents of the protruded portion, the formation of an artificial anus. *Gangrenous omentum* should be removed, the arteries having been each separately ligatured; the mass removed should be left just within the wound, in the event of circumstances in the operation for strangulated hernia, the same reasons.

The *Intestine* modifies the treatment, according as to whether it is protruded or not. 1. Wound of the intestine *within* the reach of the hand; and the discharge of fecal matter must be prevented. (a.) The patient might be laid in such a *position* that the intestine shall escape through the external wound in the event of its protrusion. Lying on the injured side may offer the most dependent position, or the recumbent attitude, with the knees drawn up, to facilitate the discharge from a wound near the umbilicus. Consideration of feculent extravasation, and the consequent peril, this mode of treatment, by position, has been abandoned. (b.) Large experience has shown that when the intestine is penetrated, without protrusion, the rule should be to close the intestinal wound by suture. *Enterorrhaphy*: having enlarged the abdominal opening, if necessary, by an exploratory incision, to find the seat of intestinal lesion. This mode of treatment should not be overlooked; for, as the intestines are within the abdomen, in searching to find the wounded intestine, extravasation is very apt to occur; and more especially if peritoneal folds of the bowel be penetrated. 2. Wound of the intestine with *protrusion*, is a condition respecting the treatment of which the Surgeons have also held a difference of opinion. (a.) Closure of

the wound with sutures—*enteroraphy*—and *reduction* of the protrusion of intestine *just* into the *cavity* of the abdomen, constitutes a plan of treatment generally applicable. The sutures soon become over with a layer of lymph, and ulceration taking place inwards, they are eventually detached and fall into the intestinal canal; while the incision uniting by adhesion, leaves a firm cicatrix. For this purpose it is necessary to bring the *peritoneal* margins into contact, as the

FIG. 108.



of adhesion. The needle used should be a fine round needle, and the sutures, fine round sewing-silk; and the whole thickness of the gut should be brought together into even apposition, and the sutures clipped off close to the knot. To avert any tendency to the escape of faecal matter in the intervals of suture, the continued or *Glover's* suture (Fig. 108) will be preferable for a wound of any extent; observing to pass the thread from within outwards, and from without inwards, alternately; thus to *invert* the

lips of the intestine, and bring the peritoneum into contact. Other forms of suture have been devised. *Lembert's* interrupted suture (Fig. 109) is quite as effectual in bringing the peritoneal margins together, and is very easy of application. The stitches are introduced, and brought out

FIG. 110.



three-eighths of an inch from the margins of the intestinal wound; and the intervals between sutures should not exceed one-fourth of an inch. But the mucous membrane is apt to *bulge* between the points of suture—a disadvantage corrected by the continuous inverting tendency of the *uninterrupted* suture. *Gely's*—another form of interrupted suture (Fig. 110)—is open to the objection, and is more difficult of introduction than that of *Lembert*. But one or other of these forms of suture will be found more effectual, and should be applied, according to the direction, and the shape, of the wound in the intestine. When the gut is turned into the abdomen the *gut* is left as an *external aperture*, to allow of free discharge in the event of sloughing. The *abdominal* wound should be closed by suture, leaving a *drainage-tube*.

(b.) Another plan of treatment, which has been recommended by some Surgeons of experience, consists in *reduction* of the protruded portion of intestine into the abdomen, *without* closure of the wound in the gut, but uniting the edge of the opening to the integumental wound, by sutures. Ad

between the two apertures, an *artificial anus* is formed. The *advantage* of this procedure is: the prevention of feculent extravasation to the mechanical closure of an intestinal wound by sutures. The *efficiency* of sutures is, however, now no longer doubtful—the *best form of suture* is a question of judgment. And the *objections* of attempting to form an artificial anus are: the liability of extravasation pending adhesion of the two apertures; and the *sad fate* of a permanent artificial anus in any part of the abdominal wall, but an extensive and transverse wound, or a lacerated wound of the rectum, may not admit of being closed effectually by suture; it will inevitably reopen by sloughing; and a wound of intestine already irreducible is unfit for reduction. In these *exceptional conditions*, the formation of an artificial anus will be expedient or unavoidable.

TREATMENT of wounded intestine, with or without prolapse, is the same as that of rupture. The principle being to prevent peristaltic action which might disturb the process of reparative adhesion, opium should be administered to confine the bowels for a week, when a *liquid diet* may be given. During this period the diet should be exclusively fluid; subsequently, a small quantity only of light food may be gradually allowed for two or three weeks.

Operations on *other abdominal organs* have been dealt with by *excision*.

Portions of the spleen, or of the pancreas, have thus been removed successfully.

Traumatic Peritonitis.—Inflammation of the peritoneum, consequent on injury, whether contusion or wound of the abdomen, or arising from extravasation—feculent or alimentary, bilious, urinary, or sanguineous—is attended by certain characteristic *symptoms*. *Pain* and great tenderness over the seat of injury, spread from the *seat* of injury over the abdomen, and with *tympanitic distension* and resonance on light percussion. The skin over the seat, which soon becomes brown, constant nausea or *vomiting*, and rigidity of the abdomen, are the main gastro-intestinal symptoms. The patient is recumbent, with his knees drawn up to relax the abdominal wall; he breathes entirely by the thorax, the thorax scarcely moving with each respiration; and the expression of the face is anxious, with perhaps a nipped appearance of the nose,—frequently dilatation of the nostrils and a bleating action of the respiration, in connection with the *short and hurried breathing*. A hiccup often adds further embarrassment; so that the patient has a panting and broken voice. The *pulse* is rapid, small, and feeble, and feeling like a *wire* drawn under the finger; increasing rapidly, or more beats per minute, it becomes proportionately weaker as vital power declines. *Effusion* takes place into the cavity of the peritoneum, and resonance is then exchanged for *dullness* on percussion, commencing in the flanks, where the fluid portion first accumulates, and gradually extending over the abdomen, as it increases in quantity. The effusion, commonly of greenish-yellow colour, may be fibrinous in character, fitted for adhesive reparation; or corpuscular and bloody, with an abundance of yellow serum, or sero-purulent fluid. The surface is more or less injected, both in its visceral and parietal surfaces, the tint of redness and form of vascularity varying in different parts of the membrane. Peritonitis after abdominal injury begins usually

order to prevent effusion beyond that requisite for adhesion and to promote absorption. Neither local depletion nor was proved efficacious in the numerous cases of traumatic peritonitis during the American War of the Rebellion; but the continued influence of the *entire abdomen* was often used to subdue the peritoneal inflammation. The action of mercury in relation to inflammatory effusion is a question; but in traumatic peritonitis, the early administration is specially advantageous, by controlling the peristaltic movements of the intestines. The *hypodermic injection* of morphia is a valuable remedy when opium would be rejected by the stomach; but opiates have a more direct effect upon the intestine. Purgatives during the inflammatory stage are useless or injurious, the constipation being the paralyzing influence of peritoneal inflammation over the action of the bowels. Beef-tea and other fluid food should be the form of nourishment given during this period. Iced soda-water seems to allay sickness, which may also be combated by lemon-juice, acid and potash, in draught, taken occasionally. At the end of the first week any feculent accumulation may be removed as a source of irritation by the gentle action of an *oleaginous enema*. In *asthenic* cases depletion should be moderated, and the vital power must be supported by wine, brandy-and-egg mixture, or other stimulants, and light food.

Chronic peritonitis will require the continued influence of blisters on the abdomen and mercurial ointment dressing to counteract the lingering effusion. Compression, by means of an abdominal bandage, may also promote absorption; although I have had no experience with the gypsum-bandage, which Neudörfer recommends, and, I believe, is only applicable in the acute stage, for the suppression of inflammation.

On the principle that chronic peritonitis may be regarded as an *abscess* of a serous cavity, the same treatment has been adopted in *empyema*. An *incision* into the abdomen, with *drainage*, to it

CHAPTER XLVII.

HERNIA.

Hernia is a generic term, signifying the protrusion of any organ from its natural cavity; such protrusion occurring through a natural or accidental aperture. Thus we recognize Hernia of the brain, through an opening in the skull; of the lung, through an opening in the thoracic parietes; of a portion of intestine, omentum, or other abdominal organ, through an opening in the abdominal wall. The protruded part is covered by the integuments, which overlie the aperture and course of the protrusion. Hernia and Rupture are frequently used as synonymous terms; but the latter term would imply some breaking or laceration of the textures resisting at the seat of visceral protrusion, a lesion not necessarily connected with the production of Hernia.

Abdominal Hernia may be considered, in its General Pathology and Treatment; and that of the various Special Forms of such Herniæ.

Situations of Hernia.—The various apertures naturally existing in the abdominal parietes offer structural facilities for the protrusion of the viscera; while apertures accidentally existing as malformations, or formed by injury or disease, also favour the occurrence of Hernia.

Taking the former as the more common and normal, or anatomical situations of Hernia, they are: above Poupart's ligament—through the inguinal canal; below the ligament—through the femoral canal; through the several apertures of the pelvis;—in front, through the obturator or thyroid foramen; through the arch of the pubes in the perinæum; below,—into the labium pudendi, by the side of the vagina; behind,—through the ischiatic notch; through the umbilical aperture; or at other parts of the abdominal wall, in ventral, epigastric, and lumbar Herniæ; and through the diaphragm.

Names of Herniæ.—Distinctive names are given to abdominal Hernia, according to their anatomical situation; the viscus protruded; the period of life at which the hernial sac is formed; the stage of protrusion; and the pathological condition of the hernia. (1.) Thus we recognize by their *situation*: Inguinal hernia; Femoral or Crural hernia; Obturator or Thyroid hernia; Perineal hernia; Pudendal hernia; Vaginal hernia; Ischiatic hernia; Umbilical hernia; Ventral hernia—at the linea alba, or the linea semilunaris; Epigastric hernia; Lumbar hernia; Diaphragmatic hernia. (2.) The *protruded viscus* gives names: Intestinal hernia or Enterocoele; Omental hernia or Epiplocele, their combination being Entero-epiplocele; hernia of the stomach or Gastrocele; of the bladder or Cystocoele. (3.) *Congenital* hernia, and its variety, *Infantile* or *Encysted* hernia, relate to the formation of the hernial sac by the persistent patency, from birth, of the vaginal process or sheath of peritoneum in the tunica vaginalis testis; the one hernia signifying complete patency of this sheath; the other, its closure at the abdominal orifice, leaving the sheath open below, and into which the hernial sac descending, the tunica vaginalis encloses the sac—forming an encysted hernia. (4.) *Complete* and *Incomplete* hernia are terms having reference to the stage of protrusion.

sion; inguinal hernia incomplete, or within the canal, is named *bubonocoele*, and when complete, scrotal hernia in the male, labial in the female. (5.) The pathological condition of hernia gives rise to highly important practical distinctions: *Reducible* hernia, *Irreducible* hernia, *Incarcerated* and *Strangulated* herniæ.

The **Hernia** consists of a peritoneal sac or pouch, with a corresponding portion of the abdominal parietes, and the sac-contents.

(1.) **Sac.**—The *sac* is a prolongation of the parietal layer of peritoneum, from the aperture in the abdominal parietes; either by gradual protrusion and distension of the peritoneum under pressure of the protruding organ, —forming the ordinary, *acquired* hernial sac; or it may be a pre-existing vaginal process of peritoneum, left open after birth as a malformation, into which sheath an organ protruding, it thus becomes a hernial sac,—the *congenital* hernial sac. Both kinds of sacs are illustrated by inguinal herniæ.

A hernial *sac* consists of two portions: the *body*, or dilated portion, the lowest part of which is sometimes named the *fundus*; and the *neck*, or constricted portion, the abdominal opening into which is named the *mouth* of the sac. These distinctive terms are convenient for description, and practically important. *Varieties.*—The sac may be *absent* in certain structural conditions of hernia; if the protruding organ be naturally partially uncovered by peritoneum, as the cæcum or bladder; in hernia within the abdominal cavity, as by protrusion through the mesentery or the meso-colon, or by the formation of an adventitious band of false membrane constricting a portion of intestine; from rupture of the sac by violence; or as the result of ulceration. On the other hand, *two* sacs may have formed, both having protruded through the same aperture, constituting a double hernia. One sac may be placed behind, or within the other. Occasionally, the sac may be bifurcated. The *neck* of the sac sometimes consists of *two* constricted portions; representing the natural anatomical condition of the surrounding parts,—as the external and internal abdominal rings, in complete, oblique inguinal hernia; or, the original neck may have slipped down with a fresh protrusion, forming the "*sacs aux collets*" of French authors. I have thus seen *three* necks produced, or corresponding constrictions, in a large scrotal omental hernia. These constrictions consist of fibrous indentations of the peritoneum; and sometimes they pass inwards as duplicatures, forming septa or partitions, dividing the sac into two cavities, which communicate by a central aperture. Occasionally, an incomplete ring has a corresponding semilunar valvular fold, within the sac; or forming an almost complete septal division.

An *old* sac has lost its peritoneal character, having become thickened, white, and opaque—an important change of appearance to be observed in performing an operation.

(2.) **Contents of the Sac—and their Structural Changes.**—All the abdominal viscera are severally subject to Hernia, though not with equal frequency; the pancreas, it is said, alone excepted. The *contents* of a Hernial sac, therefore, vary considerably. 1. They are usually the intestine or omentum conjointly or singly; the small intestine, particularly the ileum, more probably than any other abdominal viscus, owing to its long mesenteric attachment and its hanging near the abdominal apertures through which herniæ commonly take place—namely, the inguinal and

rings. The quantity of *intestine* protruded may be small,—a part of intestine, or not even the whole of its circumference, or it may extend to several feet in length. *Omentum*, varying in quantity, is folded over, or perhaps matted into a cylindrical mass; when unfolded, it has a fan shape, the base being below and the apex upwards towards the abdominal aperture. Old herniated omentum loses its peculiar adipose cellular texture, and becomes consolidated; the veins acquire a somewhat varicose condition. Sometimes apertures form in it, through which a coil of intestine passing, strangulation may happen within the sac. *Cysts*, occasionally, form in the omentum, and into which the intestine may slip. When intestine and omentum co-exist in the sac, the omentum descends in front, and will be found to enclose and protect the intestine, on opening the sac. This is explained by the situation of the great omentum, which hangs as an apron from the greater curvature of the stomach, immediately behind the abdominal wall; and so omentum is more often protruded in umbilical and inguinal than in other herniæ. 2. Occasionally, *other viscera* are herniated; the stomach, spleen, cæcum, sigmoid flexure, or other portion of the colon, bladder, ovaries, or even the kidney. 3. *Serous fluid*, of a yellowish or pinkish colour, and transparent, is always found within a hernial sac, but in a variable quantity. Usually only sufficient to lubricate the interior of the sac, this fluid may be the principal constituent, amounting to several ounces, and distending the sac. It is copiously secreted when the sac is inflamed or the hernia strangulated, and most abundantly in the final herniæ.

Adhesion of the omentum across the sac, so as to form a distinct sac or pouch below the visceral contents, and in which fluid accumulates, constitutes the condition known as *hydrocele of the hernial sac*. A considerable quantity of fluid may thus accumulate; some ounces or even pints. A division of the sac may also form a cyst, below the hernial protrusion. Or, the neck of a hernial sac may be occluded by an adherent mass of intestine or omentum, forming a closed sac; and the same condition may result from adhesion of the neck, in consequence of long-continued pressure from wearing a truss; the hernia is radically cured, but the closed sac remaining, is subject to hydrocele. The fluid of *ascites* is sometimes passed into and distend a hernial sac, as if a hydrocele of the sac. This state is distinguished by the ready return of the fluid into the abdomen on compressing the swelling, and its escape again when the hand is drawn.

Causes.—The formation of Hernia depends upon a weakness of some part of the abdominal or pelvic wall, and thus an insufficient resistance to the protruding pressure of the viscera, as subject to the compressing action of the abdominal muscles and diaphragm. The causes of hernia are, therefore, of two kinds, *predisposing* and *exciting*—under the various circumstances of muscular exertion, or occupation.

Reducible Hernia.—**SYMPTOMS.**—A colourless, soft compressible lump or swelling appears at some part of the abdominal parietes; commonly in the groin, just above the middle of Poupart's ligament, at the internal ring; or below the ligament internally, and corresponding to the inguinal opening. This tumour increases in size when the patient coughs, and still more so when he coughs, and the latter act communicates

an *impulse* more or less perceptible to the hand when placed upon the tumour; on the contrary, it *diminishes* in the *recumbent posture*, and can be made to disappear by gentle *compressive manipulation* in the direction of protrusion,—the contents of the hernial sac, with sometimes the sac itself, being returned into the abdomen, whence this procedure is denominated the *reduction* of Hernia. The tumour will probably reappear, when the patient stands upright, and the pressure is removed from the hernial aperture. There is no pain or other sign of inflammation in connection with a reducible hernial tumour.

INTESTINAL HERNIA—ENTEROCELE, and OMENTAL HERNIA—EPIFLOCELE, present tumours having *distinctive* characters and which are tolerably perceptible. 1. ENTEROCELE is *soft, compressible and elastic, uniform and globular*; it yields a *distinct and distending impulse* on coughing, and a *gurgling noise* as it returns, *suddenly*, into the abdomen. 2. EPIFLOCELE is *doughy or harder, inelastic, and uneven or lobulated*; yields a *less distinct and solid impulse* on coughing, and *returns slowly, bit by bit*, or as a *lump*, into the abdomen. Percussion cannot be trusted to distinguish intestine from omentum; for if there be faecal accumulation—solid or fluid—in the bowel, the sound elicited from that structure, or from omentum, will be equally dull. 3. ENTERO-EPIFLOCELE forms a tumour of *mixed* characters, and this is the more frequent condition of hernia; on examination fails to detect the visceral nature of the protrusion,—whether it be intestine, omentum, or both. An accumulation of *fluid* in the hernial sac will *disguise* the visceral nature of its contents, and simulate intestine.

TREATMENT.—This may be mechanical and palliative, or operative and curative.

Mechanical treatment consists in the reduction or return of hernia, by the manipulative procedure technically named the *Taxis*; and the prevention of its return, by means of a suitably fitting support or Truss. The constant wearing of such an appliance may, perhaps, lead to obliteration of the neck of the sac, and a radical cure. Until a proper truss can be obtained, a pad or compress should be applied, and retained in position by a bandage; the spica-bandage being adapted for inguinal or femoral hernia.

TAXIS.—Reduction is effected by placing the patient in the recumbent position, relaxing the abdominal muscles by bending the thigh upon the abdomen, and then gently compressing the tumour with the fingers, back in the direction of protrusion. Further particulars are given in connection with Strangulated Hernia.

TRUSS.—The qualities of a Truss should be estimated by its lightness, firmness, elasticity, and adaptation to the configuration of the wearer, with sufficient strength of spring to prevent the escape of the rupture from the abdomen. The instrument consists of a pad or cushion attached to a metallic spring, with straps so arranged that its movements during the varied postures of the body may be restrained. The various forms of trusses are noticed in connection with Special Hernia.

Irreducible Hernia.—SYMPTOMS.—This condition signifies simply that the contents of a hernial sac *cannot* be reduced or returned, entirely at least, into the abdomen; but there is *no obstruction* to the passage of *feces* through the intestinal portion, nor to the *circulation*,—the hernia is not incarcerated nor strangulated. The contents are, generally, for the most part omental, with intestine and mesentery, and the hernia is usually bag-

standing and of large size; the gut perhaps slipping up occasionally, leaving the omentum unreduced. But nearly the whole of the abdominal viscera may be herniated. Thus, in scrotal hernia, examined after death, the sac has been found to contain all the intestines, except the duodenum and cæcum, with the omentum, the pyloric orifice of the stomach being drawn down to the pubes—the fundus of the hernia extending down to even four inches below the knee.

The increasing size and weight of an irreducible hernia entails proportionate mechanical inconvenience, coupled with occasional dragging pains, nausea, or vomiting, and colicky flatulence, with disordered action of the bowels. Besides all this inherent discomfort, the hernial contents are liable to the accidental peril of *inflammation*, from injury by blows or other external violence, or from *strangulation*, on any occasion of unusual exertion. Omental hernia is less dangerous than intestinal protrusion, but there is always the risk of a piece of bowel slipping down and causing strangulation.

CAUSES.—Enlargement of the omentum or mesentery, as by an accumulation of *fat*, may lead to an irreducible condition of hernia; although the portion protruding through the mouth of the sac may be small. *Adhesions* between the sac and its contents, or adhesion of the neck of the sac, may severally produce the same result. *Contraction* of the neck is sometimes thus occasioned, or an hour-glass constriction of the sac; either of which alterations of shape will further prevent reduction. The *great size* of a hernia may render it permanently irreducible, in consequence of the visceral protrusion having formed for itself a new abdomen, and the proper abdominal cavity having undergone an altered capacity, while the viscera in either cavity have become accommodated to their new situation and relations. Hernia of the cæcum or of the bladder is irreducible, owing to their peculiar *anatomical conditions*.

TREATMENT.—The indications are twofold: to prevent any increase of size, by additional protrusion; and the peril of inflammation thence arising, or from external violence. The support of a *Truss*, with a large *hollow pad* for the *protection* of the hernia, will best fulfil these indications; but a very large hernia must be supported by means of a *suspensory bag*. Any violent exertion, or constipation, should be avoided as much as possible.

Reduction can sometimes be accomplished by diminishing the contents of the hernial sac. Mr. Bransby Cooper recommended a gradual course of treatment—confinement of the patient to bed for several weeks on low diet, with the continued application of ice to the tumour; and if it contain much omentum, the administration of small doses of blue pill and tartar emetic, in order to promote absorption of the fat. This plan has proved successful in some cases. Suspending the patient with his head downwards may induce the hernial contents to return into the abdomen. But the contents of an old hernia, when returned into the abdomen, may be a source of so much irritation, that any attempt at reduction, and especially by a mechanical and suddenly effective proceeding, should always be well considered.

Sometimes a hernia can be reduced, but cannot be kept up. This may be owing to long bands of adhesion to the interior of the sac, or partial adhesion to the neck; the protrusion returns when pressure is withdrawn, or, the sac having become partly inverted, the hernia descends again.

the sac. The latter kind of reduction is more likely to occur in femoral and direct inguinal herniæ; in oblique inguinal hernia, the connection of the sac to the spermatic cord, or the round ligament of the uterus, may prevent its inversion.

Incarcerated Hernia.—This term is intended to signify such imprisonment of the contents of a Hernia, itself *irreducible*, as shall *obstruct* the passage of *feces* through the intestinal portion; but there is no impediment to the circulation—no strangulation.

The **SYMPTOMS** are some increase of size and painful sense of weight in the tumour, *without* any tenderness or *pain* about the *neck* of the hernial sac; and this local condition is accompanied with constipation, and nausea or even vomiting. These symptoms have a *chronic* character, unlike those of strangulation.

CAUSES.—An accumulation of feculent matter or flatus in the fold of protruding intestine is the immediate cause of incarceration; but this is often preceded by constipation and the swallowing of hard, indigestible food. It occurs commonly in elderly persons, with large abdominal capacity.

TREATMENT.—The first indication is to excite the peristaltic action of the intestine, and this suggests the kind of remedial measures for removal of the obstruction; the patient remaining, of course, in the recumbent position. *Aperient enemata* answer best, and in particular a colocyath injection; purgatives administered by the mouth may operate beneficially, in the absence of vomiting. When some relief has been thus obtained, reduction of the intestinal contents may be advantageously attempted; any previous manipulation of the accumulation might tend to increase it.

Strangulated Hernia.—Strangulation of a Hernia is said to have occurred when the protruded viscera—intestine, omentum, or both—are so *constricted* that, in *addition* to functional obstruction, as of the passage of feculent matter through the intestine, the vascular communication is also intercepted and the *circulation of blood arrested*,—a condition which soon leads to gangrene.

SEAT OF STRICTURE.—Generally, the stricture is situated at the *neck* of the sac; but it may be either *in* the neck, by thickening of this portion of peritoneum; or *external* to and around the neck, by constriction of the surrounding tendinous or ligamentous structures forming the hernial aperture. These structures do not exert any active pressure upon the neck; the protruded viscus passes through an aperture too narrow for its reception, and, pressing outwardly, is resisted by the unyielding boundaries of that aperture. Hence, the precise seat of stricture may be in any portion of its circumference,—at whatever part resistance is greatest. This structural condition will be noticed more particularly in connection with special Herniæ. Occasionally, the stricture is situated in the *body* of the sac, which may have the form of an hour-glass contraction. *Lastly*, sometimes it forms *within* the sac; as a band of adhesion, or a band of thickened and adherent omentum; or there may be an aperture in the omentum constricting a portion of intestine.

STRANGULATION.—The structural changes coincident with the *strangulation* of hernia demand special notice. The visceral protrusion is *nipped* and indented at the seat of strangulation—the *stricture*. Other changes late to adhesions, the state of the *intestine*, or *omentum*, and of the

fluid in point of its colour, consistence, and odour. 1. *Adhesions*.—In a very short period plastic lymph may have been effused, and even be vascular in twenty-four hours, appearing as shaggy warts, or vesicles, sometimes having a cellular or a membranous form. Adhesions form on the sac and its contents, and especially at the neck of the sac; portions of intestine become adherent, or intestine with omentum. Adhesions are soft and pliant; more established adhesions are firmer and more unyielding. 2. The following changes take place concurrently in the state of the serous fluid and intestine within the sac, and are very important; the one as being an indication of the other. (1.) With strangulation of only a *few hours' duration*, the fluid is *pale yellow, clear*, and the intestine is simply congested, of a deep-red colour, and its texture is elastic. (2.) With strangulation of *many hours' existence*, the fluid is *dark brown, but clear*, and the intestine of a *purple tint*, but its texture retains its elasticity. (3.) With strangulation of *long duration*, or after a *long and protracted taxis*, the fluid resembles a strong infusion of coffee, is *turbid*, with blood and small coagula; the intestine is *dark purple* shading to black, it has lost its peritoneal brilliancy and becomes *dull looking*, its texture is *leathery*, silent, infiltrated with blood, and often with flakes of lymph adherent to its surface. With turbid serum, of a dull brownish colour, mixed with blood, coagula, flakes of lymph, or rarely pus, and probably having a putrid odour, the intestine—having a *blackish* or *dull* appearance, and fleshy, *softened* texture—is approaching to a *gangrenous* condition; or it has already passed into *gangrene*, when shreds of the peritoneal coat may peel off. With the escape of gas and serum, of the nature last described, bubbles are produced, and the intestine is ruptured (Fig. 111).

FIG. 111.*



Omentum passes through similar changes of congestion and gangrene; and, if unreduced, the sac and its coverings may slough, and a portion of omentum become detached, the patient sinking a *few days*.

SYMPTOMS.—(1.) *Local*.—The tumour is *irreducible*, and the *signs of inflammation* are diminished or altogether absent, owing to the intestine giving a transmission of the shock to the contents of the gut. The sensation of stricture can sometimes be thus determined, as before pointed out, by observing the line where the impulse ceases to be felt. There is a *marked enlargement* of the hernial tumour, if a gas-collecting sac; or it may recently made its appearance. It is *dense and hard*, the pain is *constant*, and in proportion to the accumulation of pus, dark in color, but if omental, the tumour may still retain its *translucent* appearance. Tenderness soon supervenes about the neck of the tumour, and thence diffused over the abdomen, which becomes *pinkish and inflamed* as peritonitis is established. The gut rises to *great distension*. Usually relieved more particularly in the morning, there is a

* See Vol. I. p. 100.

...mucus, and lastly, the contents of the intestine,—the acquiring a more or less decidedly feculent character. Yellows of vomiting sometimes occur, as if there were a rupture of the stomach. In *Omental hernia* is attended with similar symptoms, except that the vomiting is *less severe*, and the constipation is necessarily less. The symptoms of strangulation, in any case, are more acute in recent and small, than if it be old-standing and large. It is of practical importance to remember that the mere *duration* should not be regarded as a measure of their severity; only a few hours' duration may have induced a gangrene of the intestine, whereas two or three days, or a longer period, may pass in some cases, without the same result. Lastly, the position of the patient, as influenced by *peritonitis*, are peculiar. The patient lies back with the knees drawn up to relax the abnormal wall of the abdomen, tender, tense, and tympanitic; and the breathing is chiefly short, hurried catches, interrupted perhaps by hiccup,—always a bad omen. (2.) *Constitutional Symptoms*.—Inflammation accompanies the development of peritonitis, and is denoted by the following symptoms—of a *sthenic* type in the young and vigorous, and of a *typhoid* type in the old and enfeebled. Usually, the pulse is quick, small, and hard; prostration speedily supervenes; the pulse increasing rapidly to 100, 120, or more beats per minute, and becoming weak and irregular, as collapse succeeds. A cold, clammy skin, and the expression of countenance is nipped; there is often a notable *relief* of all the *abdominal symptoms*—the vomiting subsiding, perhaps even the bowels acting, and an evacuation. Yet, in this deceitful state of tranquillity, the patient is on the verge of death. Ultimately, with *gangrene*, the skin may have acquired a dusky-red colour, and the tumour may become fluctuant and emphysematous. Sometimes, with *rupture* of a spleen, of intestine, fecal extravasation takes place, when an abscess

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tion. The Surgeon steadies the neck of the tumour as far as possible with one hand, while with the other he grasps the body of the hernia; when, by a gentle, uniform, compressive manipulation, the hernia may be returned. The *direction* of the pressure is specially important; it should always be made in the course of the hernial descent, and traction downwards before using compression will sometimes aid reduction; apparently by freeing the contents from the neck of the sac. The taxis having been thus employed for a few minutes, any fluid in the sac may partially pass into the abdomen, accompanied with a diminution in the size and tension of the tumour; the flatus of the intestine may also escape into the intestinal canal above the stricture, accompanied with a *gurgling* sensation and sound, and then the intestine comes up with a *sudden jerk*. *Omentum* may then have to be reduced, and passes up gradually *bit by bit*, or a *lump* may *slip up suddenly* into the intestine. Hence we cannot always determine by the taxis whether a hernia be intestinal or omental; and the less so as sometimes the omentum goes up together.

Dilatation of the hernial aperture, by insinuating the tip of the finger into it, is most practicable in femoral hernia,—where the upper part of the saphenous opening is sharply defined, and especially as felt by the person; or in inguinal hernia,—when the stricture is seated at the abdominal ring.

The *amount* of compression justifiable, varies with the state of the strangulated intestine, as denoted by the one symptom—vomiting. If this has occurred, the pressure should be gentle; after vomiting has ceased, manipulation must be particularly delicate and cautious, lest the intestine or small bowel be irreparably damaged or burst. The *duration* of the taxis is equally important; for moderate but continued manipulation is as damaging as a violent effort at reduction, and any such effort is more likely to induce inflammation. *Half an hour* may be roundly taken as the period beyond which the taxis should not be prolonged.

placed in a *hot bath* (96°—100° Fahr.), and allowed to remain until some faintness supervenes, during which period the taxis is reapplied in the bath. This failing, he should be removed, and wrapped in blankets. Then *chloroform* may be administered cautiously, and under its influence another attempt at reduction be made, yet once more only.

Opium may be administered with advantage in one period of strangulated hernia. When vomiting has commenced, and the stomach has been emptied by two or three vomits, there is—according to Mr. Birkett's careful observation—a short interval of repose, which continues until regurgitation takes place from the small intestines. If this moment be seized, and a full dose of opium in solution, with a little stimulant, be given, the hernia can sometimes be reduced. But when once the vomiting of regurgitated fluids has supervened, the inward administration of medicine is pernicious. Purgatives are positively killing, in thus attempting to force a passage through a strangulated portion of intestine; and enemata at least useless, with the view of emptying the lower bowel, already emptied by the irritation of strangulation above. *Cold applications* to the tumour, by means of the ice-bag or ether-spray, seem to have some advantage in facilitating reduction by the taxis. The blood-vessels being thus partially emptied, the bulk of the protrusion is somewhat diminished. But the tendency to gangrene will be increased by prolonged cold. Such applications are more useful as preventive of strangulation; and after strangulation has existed twenty-four hours, cold is inadmissible.

ASPIRATION.—This method of withdrawing fluid or air has been applied to a hernial protrusion, for the relief of tension arising from the collection of fluid in the sac and feculent gas in the gut, thus perhaps rendering the protrusion reducible.

INJURIES INFLICTED IN THE EMPLOYMENT OF THE TAXIS.—They affect separately, or in combination, the hernial contents, the sac, the integumental coverings. The nature of the injury is always the same—contusion or bruising, and the bowel may be lacerated or burst.

1. Thus, with regard to the *hernial contents*, intestine being most delicate, it is more commonly injured than omentum. Indeed, the latter may sometimes protect the former. The injury liable to be done to the bowel should be estimated less by the symptoms of strangulation than by the *violence* and *prolongation* of the attempts employed in the taxis. (a.) After the first act of vomiting, and during the succeeding twenty-four hours, the bowel may be *killed* by manual pressure, or *cut* by pressure against the hernial aperture. In either case, the entire calibre of the bowel becomes divided, at length forming an artificial anus; or death takes place in consequence of feculent extravasation backwards into the abdomen. (b.) After the expiration of *twenty-four hours*, the softened state of the bowels will probably cause it to yield under any violent or prolonged use of the taxis. *Rupture* usually occurs at the convex border of the gut, at the furthest point from the mesentery, and the rent is in the direction of the circular muscular fibres.

The *signs of burst bowel* are very significant. If an enterocele, the *bowel glides* away from the pressure of the finger and the tumour disappears. But this apparent reduction is not accompanied with that sudden and peculiar gurgling subsidence which attends the return of an unburst bowel into the abdomen. The patient immediately complains of intense

pain in the abdomen, vomiting ceases, succeeded however by and hiccup, with utter collapse and death. Sometimes, inflammatory suppurative take place in the sac, and extending through its the abscess bursts, forming a fistulous communication with the intestine. Some hæmorrhage into the sac may also have been by the violence of compression, producing a mixture of blood with the flakes of lymph and pus which result from inflammation.

2. The hernial sac is subject to two forms of injury: displacement, laceration or rupture. Both may happen together, and almost in connection with considerable force.

(a.) By *displacement*, the sac is detached, to a greater or less extent, from the surrounding textures. This injury occurs usually in a hernia. The neck of the sac is more frequently affected than the body. It becomes detached from the inner surface of the abdominal fasciæ, and carrying with it the surrounding portion of the

FIG. 112 *



peritoneum, a pouch is thus formed within the fascial membrane of the abdomen; into which the hernial contents are forced, and being retained there, they are lost to touch and sight (Fig. 112). The entire hernial tumour may thus disappear into the abdomen, in a moment, the tumour disappearing, whilst the contents are still strangulated by the neck of the sac—"réduction en fausse route." No trace of any tumour will be perceptible externally, in connection with the hernia; not even a fulness or swelling would arise from the presence of the tumour, especially when thickened by inflammation. Yet a tumour may

be felt with the tip of the finger, just within the internal abdominal ring. A lump can be tilted upwards, and gives some impulse on coughing, more perceptible in the erect posture.

(b.) By *laceration* of the sac, commonly in its neck along the line of the inguinal canal, the hernial contents escape through the rent into the subcutaneous connective tissue. Under continued pressure, the hernia still passes upwards, and, by detaching the neighbouring peritoneum, gets lodged between the abdominal wall and the internal abdominal fascia. This injury is frequently produced in that variety of inguinal hernia known as coarctated, or its sub-form, infantile hernia. It is inflicted very easily under the influence of chloroform, and especially in a youthful patient.

The signs are these:—the tumour becomes smaller and flaccid, and diminishes as the pressure is continued until it almost disappears. As the hernial contents escape, the Surgeon fails to feel the well-known sensation of a gurgling jerk produced by the return of bowel into the abdomen, and the direction of this apparent reduction seems to be upwards. Symptoms of strangulation recur, and perhaps with aggravated intensity. The tumour also may reappear, and recede again under the application of slight pressure.

erings of the hernial sac are liable to injury from rough friction produces ecchymosis of the integument, with perhaps extravasation of blood and oedematous infiltration, or inflammation to suppuration and sloughing.

AFTER REDUCTION.—Vomiting ceases usually, or it may while as the effect of chloroform. The pain in the abdomen is immediately relieved, and soon pass off.

OF THE SYMPTOMS OF STRANGULATION.—1. After operation, symptoms of strangulation may arise from *three conditions*: (1) rupture of the intestine, with feculent extravasation into the abdomen; (2) displacement of the sac into the abdomen, or into the thorax; (3) rupture of the sac, and apparent return of its contents—thus agreeing in the *disappearance* of the hernia, but to be diagnosed by the differential characters dependent on each mode of production, as already noticed. 2. Certain conditions of the hernia, or of real reduction, may also perpetuate the symptoms; such as a *stricture*—within the sac, reduction having overcome only the constriction of the hernial aperture; or *persistent constriction* of the intestine, which had been protruded, as the result of plastic effusion forming a band, so that the still strangulated viscus remains paralyzed,—the bowel not performing peristaltic action, and the constricted portion becomes gangrenous. 3. The unabated continuance of peritonitis, constipation, and vomiting are symptoms of strangulation. Only a *portion* of the circumference of the intestine may thus remain constricted or indented. This nipped off piece may way some days after operation; ulceration of the mucous membrane of the bowel having taken place, followed by rupture of the intestine, either as a large rent or in numerous minute apertures. The symptoms are the same, though perhaps less marked than in the case of persistent constriction. In both conditions of persistent strangulation, if the bowels are not relieved, of the bowel occurs, overwhelming peritonitis rapidly ensues. 4. Treatment.—These various misadventures of the taxis may be treated on the same general principle. With *persistent* symptoms of strangulation, after apparent or after real reduction, an operation must be performed with the view of reaching the still existing *seat of stricture*. Care must be observed to modify the operative procedure according to the structural conditions of the hernia, as already described; regard to the apparent reduction arising, either from displacement of the sac into the abdomen, or from rupture of the sac externally. If the bowel remain constricted after its reduction, of course no doubt will be discovered by operation.

Persistent continuance of the symptoms of strangulation, due to persistent constriction, must not be mistaken for persistence, due only to the gradual subsidence or continuance, the case being hour to hour, will probably enable the Surgeon to determine the necessity for operative interference.

OPERATION FOR STRANGULATED HERNIA.—HERNIOTOMY.—The failure to effect reduction, an operation for the removal of the hernia, or to reduction, by division of the stricture and liberation of the viscus, should be resorted to without a moment's delay. The indication as to the *absolute necessity* and *extreme urgency* of the operation may be thus stated:—persistent vomiting, and especially of

a feculent character, showing the regurgitation of the contents of intestine. In describing Herniotomy as for Strangulated Inguinal (p. 621), the Student will be enabled to follow the steps of the operation and as applicable to Femoral (p. 634) and other Herniæ.

The operation for strangulated hernia is concluded, by a line of incision in the integument together by two or three points. It is well, however, to leave the lower angle of the wound open for the escape of bloody serous fluid, and insert a drainage-tube. Sutures should not pass through the sac, and if the latter be thin and thickness as to prevent the easy closure of the incision, a piece of sac may be removed for this purpose. When the bowel is laid out and it is sought to establish an artificial anus, or such an operation is formed, the wound must be allowed to remain open.

After the operation—whether in the male or female—a pad of antiseptic wool is laid upon the inguinal canal, guarded by an internal ring, and retained in position by a spica-bandage; the patient is slightly flexed on the abdomen, to ease the bandage if necessary. A proper and well-fitting *truss* must be worn.

Successful *results* have followed the operation for ordinary inguinal hernia, at a very early period of life, only a few weeks as well as in advanced age.

Artificial Anus.—This condition is said to exist whenever a fistula forms, or is made, in the intestine, through which its contents escape externally.

CAUSES.—The state of the *bowel* is, usually, *gangrenous*; it may have yielded in the sac before operation, or afterward returned into the abdomen; or it may be purposely laid open by operation, to allow of the escape of feces when that issue is *healthy* portion of intestine may, however, be accidentally destroyed by the course of operation, or by a penetrating wound of the abdominal wall. Rarely, a fecal opening results from *ulceration* of the intestine. Artificial anus occurs most frequently in the scrotal, and femoral regions; and in connection with the small intestine. The kind of discharge will depend on the part of the gut opened, and on the size of the aperture. But digestion is more or less perfect; hence the nutrition and general health of the person is impaired.

Generally, an artificial anus forms *after* operation,—the bowel has been returned into the abdomen. The *probability* of its occurring depends very much on the advanced state of gangrene,—short of which case the bowel would not have been returned. But gangrene itself depends principally on the tightness of the constriction, which the bowel has been subjected, as well as the duration of the operation. The *deeply constricted* appearance of the strangulated bowel indicates the probability of sphacelus supervening,—and thence the formation of an artificial anus.

SIGNS.—Commencing at a *variable period* after operation,—usually, only, or a few days, perhaps even some weeks,—the wound, at least in part, and the dressings are seen to be soiled with *fecal* matter, while the opening emits a *gangrenous fecal* odour. The discharge increases, and becomes continuous, until an artificial anus is established.

VARIETIES.—Artificial anus differs according to the *extent* of aperture; either as a sloughing perforation in the bowel, or sloughing of the entire circumference of the canal. (1.) Sloughing *perforation* usually takes place at the centre of the convex free border of the knuckle of intestine,—at first most distant from the mouth of the sac; a small ulcerated opening produced, which does not interfere with the continuity of the intestinal canal, although allowing a portion of its contents to escape. This condition is sometimes distinguished as *fecal fistula*. (2.) Sloughing of the *entire* circumference of the intestine usually occurs at the mouth of the sac; the continuity of the canal is destroyed, and all the feculent matter escapes through the opening. The coats of the bowel are endowed with different powers of resistance to the process of ulceration whereby the slough is healed. Thus, by constriction of the bowel, a sulcus or groove is produced on its serous surface, without any trace of abrasion; but the mucous membrane presents a circular line of ulceration. Very rarely, as the result of long-continued constriction, and the pressure upon two *portions* of intestine *laterally*, their walls become adherent; ulceration follows, and the continuity of the canal is thus naturally restored within the abdomen.

In the *first* condition referred to, *repair* frequently takes place; the wound closes, the integument heals, and complete recovery results.

In the *second* condition, frequently, an artificial anus is at length *established*; and which never, or very rarely, undergoes spontaneous cure. *Completion* is as follows:—The margin of the intestinal aperture—whether the whole or a portion only of the calibre of the intestine—becomes firmly adherent to the abdominal peritoneum; the openings of the upper and lower end of the canal are, at first, equal in size and lie nearly on the same line. Subsequently, they unite at a more or less acute angle, presenting an intermediate spur-like portion or *partition*, of *double-walled* tissue, opposite the mesenteric attachment, and bisecting the aperture externally. Of these two openings thus leading into the canal, the distal one, gradually ceasing to transmit feces, becomes smaller, and the portion of intestine atrophies; whilst the gastric end, doing double duty, becomes enlarged and thickened. The partition elongating, and acting as a valve, closed towards the distal end, it tends to obstruct the intestinal passage of feces; and thence the relative size of the two openings is still further exaggerated. Around the general aperture, the mucous membrane sometimes acquires an everted protruding appearance, or an actual *lapsus* of the membrane may take place; while the surrounding skin puckered, and is irritated and excoriated by the feculent matter issuing.

DEPTH.—The communication between the bowel and integument may be *immediate*,—through the adhesive junction of the mucous membrane and skin; they may even be placed at some distance apart, a channel intervening between two apertures, internal and external. This modification of artificial anus occurs when the knuckle of intestine is lodged deeply; in the neck of the sac, or within the abdominal cavity when an irretrievable portion of intestine has been returned. In the latter case, fecal matter begins to issue, a few days after operation, and gradually increases in quantity; until, from merely staining the dressing, the nature of the communication is plainly declared. The *extent* of intestine destroyed by the formation of artificial anus, varies to two and three inches or more;

over the aperture, or by making an oval incision on each of the outer edges of the incision together by means of a twisted suture.

(2.) A *large* aperture, and fairly *established* artificial rarely contract and close, but requires a special surgical cure. 1. The object is twofold; to *destroy* or *diminish* the *partition*, in order to regain the continuity of the intestine to *close* the *external aperture*. The destructive part of this may be accomplished by repressing the septum, according to the method, by means of a tent thrust into both intestinal canals. This may be more surely accomplished, and with equal safety proved to be observed, by strangling the septum; for which purpose the *entérotôme* is admirably adapted. This instrument is similar to a pair of forceps, worked by a screw across the end of its handle. The blades are grasped and compressed between the blades, and the pressure is increased by daily turning the screw, until the blades meet, and the intervening septum has sloughed away in a week or ten days. The septum is thrown out simultaneously, whereby the peritoneum is opened, when the instrument is withdrawn. Hence the care must be taken not to grasp the septum too high up towards the mesentery, as the compression in concert with the plastic effusion. Should vomiting or nausea may be induced, but no rigors or febrile disturbance. The continuity of the canal having been re-established, the margins of the anal aperture must be pared and brought together by a suture. 2. But the constant discharge of fecal matter tends to keep the aperture open; it was therefore proposed by Acrel to feed the patient with enemata, and life has been thus supported for a period of several months, which the aperture contracted, and at length closed. The bile occasionally produced pain and excoriation, but this was relieved by giving a spoonful of broth by the mouth from time to time. When the artificial anus has become entirely closed, the bowel remains weakened, so that any fecal obstruction, and perhaps labor

y avoided; a piece of sponge being inserted into the anal ile separating the parietal adhesions; and by taking care to ortion of gut out of the abdomen, before dealing with the ut the great proportionate fatality—of one death in four, would t such interference to exceptional conditions of artificial anus. eritonitis cannot be averted merely by antiseptic precautions gency of any fæcal extravasation, at the time of operation or

manent artificial anus sometimes remains, having resisted all closure. This sad state may be made more tolerable by aathern receptacle or other contrivance; and it is gratifying patients have thus been enabled to live in comfort and the of good general health for many years. An artificial anus h up in connection with the intestine, and which discharges me, will of course constantly deprive the patient of nutriment; e must be supplied by a proportionately increased quantity of od.

Hernia.—A protrusion on both sides of the body, symme- he same parts, or unsymmetrically, in different regions, not occurs. More than two such herniæ are occasionally met ir A. Cooper records a case of six co-existing herniæ in the t,—three on one side, an inguinal oblique, a direct, and a ia, with the same on the other side. In any such case f strangulation may be referable to this hernia or to that, and es very difficult to determine which is the seat of strangulation. ouble hernia, the operation may, perchance, be performed on here, when the sac is laid open, there is no appearance of e in the hernial protrusion. What should then be done? The astified in operating on the other side, with the view of saving s patient.

CHAPTER XLVIII.

SPECIAL HERNIÆ.

Hernia.—Inguinal hernia is that in which the visceral pro- pries part of the whole of the inguinal canal, presenting an ernia or *bubonocoele*; or, passing through an external abdominal nes a *complete* or *scrotal* hernia, sometimes named *oscheocoele*. e, it passes into the labium. The hernia occurs in two princi- as to its direction and relation to the deep (internal) epigastric hich are designated, accordingly, the *oblique* or *external* ia, and the *direct* or *internal* inguinal hernia. Thus, in point e, the hernia may take place through the internal abdominal low the oblique course of the spermatic cord in the inguinal e perhaps passing through the external ring and into the e, the protrusion may come directly through the conjoined

as an independent sac—constituting what is also termed an
In the one condition, the *vaginal process* or sheath of perito-
obliterated; in the other, it is unobliterated *below* the internal
ring.

There are, therefore, three varieties of inguinal hernia: o-
ternal; direct or internal; congenital, and its sub-variety,
encysted.

Oblique Inguinal Hernia.—COURSE.—This is the m-
form of inguinal hernia. Its course is the same as that of t
its passage from the internal abdominal ring through the in
and external ring into the scrotum; this route correspondin
spermatic cord in the same extent of its course.

The *cord* lies behind or underneath the hernia, the *testi-*
somewhat behind its lowest part—the fundus, and these two
distinctly separate (Fig. 113). Occasion

FIG. 113.*



ments of the cord are dispersed by the
scent; the vas deferens lying on one
spermatic vessels on the other; and rar-
lies partially or entirely in front of the
testicle also below being in front. In th
sometimes, the elements of the cord ar
in front of the hernia. The *epigastric a*
from the external iliac about a quarte
above Poupart's ligament, bends inwards
beneath the fascia transversalis, immedi-
and *internal* to the mouth of the sac—at
abdominal ring, which is thus placed ex-
course of this artery varies, however, w
tion of the hernia, and occasionally
abnormal origin of the vessel. In *old-stan*
the dragging pressure of the tumour

and inwards, curves the artery in that direction towards the

SEAT OF STRICTURE.—Commonly, the stricture is situated at the *mouth of the sac*, in the internal abdominal ring; next in order of frequency at the *neck of the sac*, in the inguinal canal; lastly, at the *external abdominal ring*.

Direct Inguinal Hernia.—**COURSE.**—This variety of inguinal hernia passes forward through a small triangular space, bounded by the epigastric artery *externally*, the margin of the rectus muscle on the inner side, and the spermatic cord *internally*—its inner portion—below (Fig. 114). This space is situated just behind the external abdominal ring, the conjoined tendon and the transversalis intervening.

The *spermatic cord* lies on the outer side of the sac, the *testicle* below it, and both are distinctly separate; the *epigastric artery* also lies up *external* to the mouth of the sac, curving over it inwards, so as to embrace the upper as well as the outer margin.

SEAT OF STRICTURE.—Commonly, the stricture is situated at the *mouth of the sac*; next in frequency at the *conjoined tendon*, when ruptured; lastly, at the *external abdominal ring*.

In the *female*, the anatomy of Inguinal hernia, oblique and direct, is

FIG. 114.*



FIG. 115.†



essentially the same as in the male; except that the round ligament in the female inguinal canal takes the place of the spermatic cord, and the labium pudendi of the scrotum. Females are liable to both forms of inguinal hernia, oblique and direct, occurring at very early periods of life. Excepting umbilical hernia, *oblique* inguinal is the only kind developed before five years of age; until the age of puberty, it is more common than any other variety of hernia. This form is not much more rarely met with than femoral, as generally supposed. But *direct* inguinal hernia is certainly very uncommon in females at any age.

Signs of Ordinary Inguinal Hernia.—The *OBLIQUE* variety comes on as a slight fullness or swelling at the internal abdominal ring, just

* St. Thomas's Hosp. Mus.

† Roy. Coll. Surg. Mus.

above the centre of Poupart's ligament; next, passing downwards and inwards in the inguinal canal, it presents an *oblong tumour* having that direction, in this situation—an incomplete inguinal hernia, or *bubonocoele* (Fig. 115). Still further protruding through the external abdominal ring and descending into the scrotum, or the labium in the female, the tumour enlarges into a *globular* form,—as a complete, or *scrotal* hernia. It may attain to an enormous size, extending down even to the knee; although of far smaller size in women, unless in quite exceptionally rare cases, where the hernial tumour has extended two-thirds down the thigh. But—in males—the *testicle* can always be felt *distinct* at the *bottom* and back part of the *fundus*. The usual *symptoms* of hernia are perceptible; enlargement and impulse on coughing in the erect attitude, diminution and disappearance of the tumour when compressed, in the recumbent position. These symptoms will, however, be more or less perceptible, according to the size of the hernial protrusion; being less so when it occupies the inguinal canal, as *bubonocoele*, and most conspicuous in *scrotal* hernia. In *old-standing oblique* hernia, the neck of the sac is dragged downwards and inwards towards the middle line; so that the distinctive shape of the inguinal portion is lost, and the tumour comes to resemble the next form of inguinal hernia.

DIRECT Inguinal hernia presents a *tumour* which differs in situation, and somewhat in shape and size, from that of the oblique hernia. The direct variety is *situated* at the *external abdominal ring*, near the root of the penis, the outer portion of the inguinal canal remaining unoccupied; the tumour is more *globular*, not pyriform as in the oblique, and it has a wider neck; usually, it is *not* so large. The other *symptoms* are similar; but, when strangulation occurs, I have noticed that the pain caused by even moderate taxis is greater than in the oblique form of hernia; and as arising, apparently, from pressure of the tumour on the spermatic cord in the unyielding angle between the pubic crest and the external pillar of the abdominal ring.

The *proportionate frequency* of the two forms of inguinal hernia may be remembered in connection with their diagnosis. Direct inguinal hernia is met with far less frequently; Cloquet estimating the proportion at one to five oblique herniæ, or twenty per cent.; or in only ten per cent., according to Hesselbach's computation.

Both varieties of inguinal hernia may *co-exist* in the same individual; or double inguinal hernia, one on either side, is occasionally met with. Not unfrequently, the hernia on one side is incomplete—a *bubonocoele*; and on the opposite side, an ordinary complete inguinal hernia—a *scrotal* hernia. In one case, a double inguinal hernia occurred on the same side, forming an anterior and a posterior sac; the spermatic cord lying behind the latter and the lower portion of the anterior sac.

Congenital Inguinal Hernia.—The peculiar structural condition is this: the *visceral protrusion* lies in the *tunica vaginalis*, with, and in contact with, the *testicle*, when that organ has previously descended from the abdomen into the scrotum.

The **COURSE, COVERINGS, and RELATIONS** of the hernia are the same as those of the ordinary oblique, except that the *sac* is the *tunica vaginalis*, and the relation of the *testis* is immediate, it being within the sac, although the situation of that body, as lying below and somewhat behind the hernial

contents—not the fundus of the sac—remains unaltered. But it is possible for the hernia to descend even below the testis, leaving that body behind it. The visceral protrusion passes down from the abdomen, through the vaginal process of peritoneum which connects the peritoneal cavity with the tunica vaginalis; this process having remained *unobliterated* after birth, instead of closing as usual in about three weeks or a month. Paletta states that, normally, the complete closure of the vaginal canal takes place from the twentieth to the thirtieth day after birth. But when the canal remains pervious, although the tendency to this hernia thus dates from birth, it may not occur for years afterwards. Hence the hernia itself is *not*, properly speaking, Congenital, and it might be more correctly designated, “hernia into the vaginal process of the peritoneum.” Occurring, therefore, in early life—in infants a few weeks or months old—this species of hernia also occurs, for the first time, at perhaps any subsequent period of life. It may occur on either, or both, sides.

The relation of the *testicle* to congenital hernia is very important; associated with congenital persistence of the vaginal process of peritoneum, the testis on the same side frequently occupies an *abnormal situation*. There will then be two persistent congenital conditions, both arrests of development; the one, an unobliterated state of the vaginal process of peritoneum, which should be temporarily provided only as a sheath for the descent of the testicle into the scrotum; the other, an *arrested descent* of the testicle. Congenital hernia may, therefore, not as usual contain the testicle in the tunica vaginalis or hernial sac, the testis never having descended into the scrotum.

The *Abnormal Conditions of the Vaginal Process* of peritoneum, in connection with the *Abnormal Situations* of the *Testicle*, and the relative positions of the *Hernia* to this organ, may be thus tabulated (Birkett):

(1.) The *vaginal process* continuing open and common to the cord and testis.

The *testis* may be situated—

- a. in its normal site at the fundus of the scrotum;
- b. just outside the external abdominal ring, or between its pillars;
- c. within the inguinal canal;
- d. within the abdomen.

N.B.—In a, b, c, the *hernia* is generally in contact with the testis; in d, it is not.

(2.) The *vaginal process* of the cord and testis communicating by an intermediate aperture.

The *testis* is in the scrotum.

N.B.—The *hernia* may or may not pass through this aperture, and is therefore sometimes but not always in contact with the testis.

(3.) The *vaginal process* of the cord only being open—Hernia into the funicular portion of the vaginal process. This condition was first described by M. Malgaigne.

The *testis* is in the scrotum.

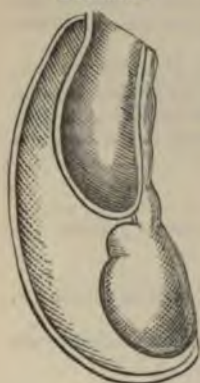
N.B.—The *hernia* is never in contact with the testis.

(4.) *Additional sacs*, or prolongations and extensions of the vaginal process, sometimes exist *within* the *abdominal walls*;—“*intra-parietal*,” “*inter-muscular*,” “*interstitial*, hernial sacs,” “*hernie-enbissac*” of French authors. Coincident with misplaced testis there may, therefore, be an abnormal dis-

position of the hernial sac, itself abnormal. An offset from the vaginal process of peritoneum, forming a *second sac*, may extend into the substance of the abdominal wall. The hernial sac will then consist of two parts, that division which passes along the inguinal canal into the scrotum, and that which is lodged in the wall of the abdomen. This *extra sac* extends in one of two directions: into the anterior, or into the inferior, wall of the abdomen. 1. In the one direction, the sac passes *upwards* from the inguinal canal *between* the internal abdominal fascia and the aponeurosis of the external oblique muscle; coursing directly upwards, outwards towards the crest of the ilium, or inwards towards the rectus muscle and umbilicus. Very rarely, the sac comes *forward through the external abdominal ring* and cannot enter the scrotum; it *ascends between* the aponeurosis of the external oblique and the integument, and when the hernia protrudes it forms a tumour in the *groin above and parallel* with Poupart's ligament. 2. In the other direction, the sac passes *downwards, between* the internal abdominal fascia and peritoneum, into the *iliac fossa*, and rests upon the iliacus muscle; or *inwards, behind* the horizontal ramus of the pubis, reaching the side and front of the urinary bladder.

INFANTILE OR ENCYSTED HERNIA.—This variety of congenital inguinal hernia co-exists with another abnormal condition of the vaginal process of peritoneum. The *abdominal orifice is closed*, and the *sheath persists* from that point downward to the testis, and there expands into the tunica vaginalis, as in ordinary complete congenital hernia. The *visceral protrusion* carries before it a portion of the parietal peritoneum of the abdomen, *into or behind this sheath*. Thus the protruded part, together with the sac, are contained in the tunica vaginalis; or it may be said, that the tunica vaginalis is continued up to the abdominal ring, and encloses the hernial sac. In this manner the hernia is encysted; and a *double sac* is discovered.

FIG. 116.*



operating on such a hernia, the tunica vaginalis is found lying in front of the true hernial sac (Fig. 116). Compared with the more frequent occurrence of ordinary congenital hernia, the encysted variety is rare. Unlike the former, it does not necessarily arise at the earliest period of life; so that the term *infantile* is inappropriate.

SIGNS.—(1.) CONGENITAL HERNIA.—The congenital condition presents no peculiar characters whereby it can be distinguished from the ordinary oblique inguinal hernia, excepting with regard to the relation of the testicle to the hernial tumour.

1. In *scrotal* congenital hernia, the *testis cannot be felt separate and distinct*; although the situation of that body below and somewhat behind the hernial contents—not the fundus of the sac—remains unaltered, in contrast to the ordinary complete congenital hernia. The *scrotal tumour is round* and the *neck more narrow and contracted*. The latter sign is more marked when the hernia has not descended for some time after birth, as the vaginal process of peritoneum will then have become condensed.

* St. Thomas's Hosp.

feeling like a somewhat enlarged and indurated spermatic cord. In the adult, this long narrow neck is specially characteristic of scrotal congenital hernia. But the more defined scrotal swelling may be mistaken for hydrocele.

2. In congenital hernia, scrotal or inguinal, with undescended testicle, the absence of this organ from its normal situation will declare the nature of the hernia. The testis may be found just outside the external abdominal ring or between its pillars; within the inguinal canal; or within the abdomen. Still, in the first two modifications of congenital hernia, the hernia is generally in contact with the testis; in the last named it is not so.

An inflamed undescended testicle simulates the symptoms of strangulated hernia; thus obscuring the diagnosis of these two conditions,—orchitis and congenital hernia presumably strangulated. In the inguinal canal, the tumour, having an oblong shape, may be tense and painful, with some abdominal tenderness emanating from that situation, and there may be perhaps nausea and constipation. But if it be the orchitis of a misplaced testicle, these symptoms subside after a while, and especially the constitutional disturbance; leaving only a tumour of diminished size, the testicle, in the inguinal canal. And the absence of this organ from the scrotum will have suggested, in the first instance, the probable nature of the case. In any case of supposed congenital or infantile hernia, the duration of the tumour from childhood, in some instances, will throw some light on the question of diagnosis.

(2.) ENCYSTED hernia presents no distinctive characters from congenital hernia; but the testicle can be felt distinct from the hernial contents, at the bottom of the scrotum. The precise nature of the hernial tumour is, however, usually discovered only during an operation, when requisite for the relief of strangulation.

Diagnosis of Inguinal Hernia.—Every inguinal hernia escapes from the abdomen above Poupart's ligament.

Femoral hernia is distinguished as follows. When inguinal hernia is confined to the inguinal canal—as an incomplete hernia or bubonocoele—Poupart's ligament can always be traced along its inferior border, and the hernial aperture is situated above this ligament. In this way the tumour is distinguished from femoral hernia, which is situated below the ligament, and this hand can always be traced along the superior border of the tumour. When the hernia has become scrotal, it will have escaped through the external abdominal ring, the pillar of which is attached to the spinous process of the pubes. Placing the point of the finger on this process, if the neck of the tumour lies internally—between the finger and the symphysis pubis, the protrusion must have passed through the external abdominal ring, a demonstration of its being of inguinal origin. A hernial tumour situated to the outer side of the finger, will probably have passed through the crural ring, and thence be a femoral hernia. But, in rare cases, complete inguinal hernia is not scrotal; the protrusion, having passed from the inguinal canal, through the external ring, descends downwards and turns outwards into the bend of the thigh—appearing, in situation, as if a femoral hernia. This may be owing to a deficiency in the external pillar of the ring, or of the anterior wall of the canal, whereby the inguinal protrusion may more nearly resemble a femoral hernia. But the neck of the tumour, at the hernial aperture or internal ring, is still always above Poupart's ligament.

Chronic tumours in the inguinal region and scrotum respectively, may, with regard to their diagnosis from inguino-scrotal hernia, be divided into two classes—reducible and irreducible tumours.

Reducible tumours comprise—(1) inguinal hernia—also congenital, and infantile or encysted; (2) hydrocele of the vaginal process of the peritoneum; (3) hydrocele of the funicular portion of the same process; (4) varicocele of the spermatic veins; (5) abscess descending through the inguinal canal.

Irreducible tumours may be either fluid or solid, or mixed solid and fluid. The fluid are—(1) hydrocele of the tunica vaginalis testis; (2) hæmatocele in the same sac when first developed; (3) encysted hydrocele of the epididymis; (4) hydrocele of the spermatic cord. The solid or solid and fluid, are—(1) diseases of the testis (*a*) of inflammatory origin, (*b*) specific new growths; (2) undescended testis in inguinal canal—also inflamed; (3) old hæmatocele; (4) diseases of the spermatic cord; (5) growths of fat extending from the inguinal canal into the scrotum; (6) diseases of the tissues of the scrotum. The *differential* characters of all these diseases, presenting swellings or tumours in the inguino-scrotal region, are described in other parts of this work.

The *co-existence* of inguinal or inguino-scrotal tumours or swellings, when it occurs, will always complicate the diagnosis. Thus, *Scrotal hernia* may be complicated by the co-existence of *hydrocele*. Yet the two swellings retain their distinctive characters;—the hernial portion having an impulse on coughing and being reducible; and usually defined from the hydrocele by a constriction or boundary, more or less perceptible to the touch when handled, and even to the eye when the patient stands up. The hydrocele is, commonly, anterior.

Treatment.—Inguinal hernia, in common with other herniæ, requires different treatment according to whether it be reducible, irreducible, or strangulated; besides which there is the special adaptation of treatment to the special varieties known as congenital and encysted herniæ.

Operations for the *radical cure* will afterwards be described.

REDUCIBLE HERNIA should be returned, as soon as possible, by employment of the taxis; care being taken that this manipulation of the tumour be conducted gently, in the manner already fully described. The *direction of pressure* is particularly important; and the terms oblique and direct, with regard to inguinal hernia, will sufficiently suggest the course of the hernial protrusion. But, in *old* oblique herniæ, the canal will have become *nearly direct*, from the constant dragging in and dilatation of the internal or deep ring. In *children* also, the canal is very direct, the two rings lying nearly opposite each other. When reduced, a suitable and well-fitting *truss* must be applied and worn. The *pad* must be so *adjusted* as to fairly close the *hernial aperture*; in the oblique inguinal, it should press not only upon the external abdominal ring, but also upon the whole length of the anterior wall of the inguinal canal; in the direct inguinal, the external ring only need be closed. Some pain or discomfort, owing to pressure on the spermatic cord, may require a little readjustment of the truss.

The *measurements* necessary to insure a properly fitting truss are practically very important, and requisite for the Surgeon to know; especially when he has to communicate with the instrument maker at a

distance, as in London from the country. Take the common forms of herniæ—inguinal and femoral. The whole circumference of the pelvis must be measured, lest any perchance natural difference on one side should alter the proportion of the truss. Place the end of the measuring tape over the lower hernial aperture, draw it in a slanting direction upwards to about two inches below the crest of the ilium, thence round the back to the same point on the opposite side, slanting down again to the aperture (Fig. 117). The size of the truss will be represented by the number of inches thus measured. The kind of pad—in respect to its shape, size, and attachment to the circumferential portion of the truss—must also be stated. Lastly, the kind and side of the hernia.

A truss having been applied, it should be *tested*, by desiring the patient to sit on the edge of a chair, with his legs wide apart, bending the body forwards, and then to cough. If in that posture, and with such effort, the hernia still remains up, without any tendency to slip down behind the pad, the truss fits well, and will prove effectual under all ordinary circumstances. The truss should be worn daily, and taken off only at night. Irritation consequent on continued pressure of the pad, may be relieved by washing the skin with a spirit lotion, and substituting an elastic air-cushion for a while. A piece of adherent omentum may undergo inflammation, suppuration, and gangrene from the pressure of a tight truss, leading even to peritonitis.

STRANGULATED HERNIA. —

The *operation* for strangulated hernia has for its *objects*, the removal of the impediment to reduction, by division of the stricture; the liberation of the protruded viscus, and its return into the abdomen. The *steps* of this operation consist in exposing and opening the sac—when necessary to reach the stricture, finding and dividing the stricture, the management of adhesions, and of the visceral protrusion.

The *instruments* required are few and simple—a scalpel with a single-cutting edge; dissecting-forceps; directors, straight and curved; Key's broad hernia-director; bistouries, blunt-pointed, straight and curved, for dividing the stricture, or Sir A. Cooper's *hernia-knife*; retractors. It will thus be seen that the only peculiar instruments are the hernia-director and the hernia-knife.

This operative procedure may be described as follows:—The patient

FIG. 117.



lying on his back, and under the influence of chloroform, and the having been shaved, an incision is made in the course of the neck of the tumour, by pinching up the skin transversely about opposite the external abdominal ring, and transfixing the fold (Fig. 118). Any small bleeding arterial vessel had better be secured by a pinch or twist with the forceps so as not to obscure the dissection. Then, cautiously dividing the superficial fascia and other coverings, by using the scalpel with a lateral,

FIG. 118.



cutting action, or even cautiously, by dividing textures successively with a hernia-director, the sac is reached below the external ring, or above that position, on thus dividing the dense aponeurosis of the external oblique. But the cord lies in front of the sac; if so, it must be divided to one side, out of the way. The sac is recognized by its appearance: thin and translucent, and transmitting the colour of its hernial contents, in recent hernia; and opaque white, in old hernia.

The seat of stricture is then sought for, as it may be found per external to the sac; either at the external abdominal ring, the base of the internal oblique muscle, or, most frequently, at the internal abdominal ring,—in oblique hernia; or at the external ring, the margin of the joined tendon when ruptured, or, most frequently, at the mouth of the sac,—in direct hernia. If situated at either of the more superficial points, regard to either form of hernia, the stricture can be divided *external* to the sac, and then sometimes the hernia becomes reducible. Otherwise, the seat of stricture being *internal*, as it usually is, or if the symptoms of *strangulation* have been *persistent*, the sac must be *opened*, and in an ordinary manner. By carefully nipping up a small portion with forceps, and using the knife flatwise, a small button-hole incision is made; this aperture is then enlarged by slitting the sac upwards and downwards cautiously, on a broad hernia-director, and with a probe-pointed bistoury. If the director be elevated so as to stretch the sac over it, there will be scarcely any risk of wounding the bowel, which might otherwise occur with the instrument. But I generally use my finger as a director, in these operations for hernia.

The seat of stricture is then sought for by gently examining the viscous contents of the sac. Situated commonly at the neck of the sac, the stricture must be divided with the *hernia-knife*, protected by the finger (Fig. 119). The *direction* in which it should be used has reference to the course of the epigastric artery. In oblique hernia, this vessel lies immediately internal to the mouth of the sac; in direct hernia, it courses internally. Consequently, the knife should be turned away in the oppo-

direction, respectively. But, owing to the dragging pressure, inwards, of an old-standing oblique hernia, it comes to stimulate a direct hernia,—the artery, however, still being *internal*. Hence, the safest direction for using the knife, and dividing the stricture in either form of inguinal hernia, is neither outwards nor inwards, but directly *upwards*. This should be observed as an absolute rule.

Reduction of the visceral protrusion is determined by the state of the parts. They should be carefully examined to discover whether there are any *adhesions* either between the parts, or between them and the sac; and to ascertain also whether the *protruded parts* and the seat of constriction are in a sufficiently *healthy* state for reduction.

If the hernia be, as usual, an entero-epiplocele, the intestine will probably be seen, or more entirely, on drawing aside the omentum. Provided both be healthy and without adhesions, the *intestine* should be gently drawn down, to see that the constricted part also is not gangrenous, and to efface the indentation which otherwise might remain; then, reduction is effected by a gentle kneading action with the fingers to empty the gut and replace it, followed by a similar manipulation to replace the *omentum*. Larger portions of either may be returned, bit by bit, from one end adjoining the hernial aperture and followed gradually to the other end. In concluding the operation, the point of the *finger* should be gently *introduced* into the abdomen, to feel that the mouth of the sac is free, excepting in those unusual cases where the bowel or omentum is allowed to remain unreduced. The *bulk* of intestine, owing to its quantity and distension with flatus, will sometimes render the reduction of the whole mass impracticable. The bowel has then been punctured with a grooved needle, to allow the flatus to escape. The result was completely successful. Aspiration might be employed with even more advantage, and without any risk of feculent extravasation subsequently.

This operation is more or less extensive, in proportion to the *completeness* or *incompleteness* of the hernia; as scrotal, or a bubonocoele. In rare cases, the absence of a sac may perplex the operator; as in inguinal hernia of the cæcum, sigmoid flexure of the colon, or urinary bladder. Reduction cannot perhaps be accomplished, when the stricture is divided, and the protrusion must be left *in situ*; but afterwards, it has sometimes disappeared spontaneously.

In the *female*, the operation is precisely the same; merely substituting the round ligament for the spermatic cord, in the inguinal canal; and the labium pudendi for the scrotum, in scrotal hernia.

COMPLICATIONS IN THE OPERATION.—*Adhesions* must be dealt with

FIG. 119.



With a *gangrenous condition* of the intestine and omentum of the *bowel* will determine the propriety of its reduction, or formation of an artificial anus. 1. *Gangrene* short of sphacelus is amenable, and this more favourable condition is indicated by however approaching to black, still retaining its peritoneal smoothness; provided the constriction of the strangulated bowel is effaced by gentle manipulation, without damaging the bowel affected. A *nipped* state of the bowel, when returned, would be followed by sphacelus and sloughing, with the formation of an artificial anus. When the *blood-vessels* can be distinguished, if they fill on gentle pressure between the thumb and finger, the Surgeon will judge that the circulation has not stopped. In this state, the bowel may be returned just into the abdomen, where it will perhaps recover from the event of sloughing, the aperture may be closed by peritonitis, and the slough pass into the intestinal canal without faecal escape, or the faeces and slough will escape through the wound, as a favourable issue. 2. *Sphacelus* is of course irrecoverable, and the difference of opinion is as to the propriety of dividing the stricture. If divided, when the bowel gives way, faecal matter will probably escape into the abdomen,—increasing the peritonitis to a fatal termination. Therefore, should be left unreduced, and a free incision made for faecal discharge through the wound. Lawrence and Traverses were of opinion the stricture undivided. Sir A. Cooper, Key, and Dupuytren, advocate division. But the peril of dividing the stricture is not entirely obviated by this procedure. Spence, therefore—having divided the stricture—draws the gangrenous portion of bowel downwards beyond the wound into the abdomen, and there leaves it for some hours, until the portion into the abdomen is defended by effused lymph; then he makes a free incision, or rather cuts off the gangrenous portion. If the gut has already become gangrenous, a similar proceeding will be appropriate; *division of the stricture* and *the bowel left unreduced* in the sac. In this state, adhesions will

extensive adhesions is equally unfit for reduction. 2. But a *large mass* of protruded omentum, or an omental protrusion which has become hypertrophied, indurated, or otherwise changed in structure, as in old herniæ, are conditions in which, if returned, it would excite peritonitis. The omentum must either be left in the sac, or removed. If left in the sac, the advantage and disadvantage are these:—Usually, the omentum shrinks up, and eventually the wound heals, but with more or less of a tumour remaining at the hernial aperture; a condition which may prove useful in plugging up the aperture, although it will interfere with the efficient application of the pad of a truss. Or, the omentum is liable to become inflamed, to suppurate and slough; delaying considerably the healing of the wound, and inducing septicæmia. The safer practice, therefore, is to *excise* the protruding portion, rather than encounter the risk of leaving it. *Ligature* of the mass is always necessary; both to prevent the risk of hæmorrhage from the highly vascular omentum, and the peril of extravasation backward into the peritoneal cavity, beyond the reach of surgical interference, and which would be provocative of peritonitis. The mass may be ligatured by means of a *single ligature* of whipcord or catgut, tied tightly round the neck, or passed by *transfixion*, the loop divided, and each half tied separately; or the omentum may be ligatured in *successive portions*, so as to tie the vessels separately. The one proceeding was formerly supposed to have the disadvantage of inducing peritonitis by constriction of the omentum; an evil consequence which has, however, been disproved by the results of more recent experience. But ligature of the vessels singly has the advantage of more surely preventing hæmorrhage, when the ligatures become detached. Excision should be performed *close* to the *external aperture*; care being taken to leave the stump of omentum *in* the aperture, and to secure it there by fixing the ligature cord or cords with a strip of plaster on the adjoining part of the abdomen. The stump, thus occupying the orifice, is free in the event of hæmorrhage, and it forms a plug which permanently obstructs the descent of a hernia, and which is quite as effectual as when the whole mass is left. Ligature and excision of the omentum must always be very carefully performed; before applying the ligature, the omentum should be unfolded to see that it does not envelop a knuckle of intestine, and in using the knife, care must be taken not to touch the bowel.

ACCIDENTS IN THE OPERATION.—*Wound of the Intestine* happens occasionally; this accident occurred in the skilled hands of Sir A. Cooper, and in those of Sir W. Lawrence, Liston, Jobert, and J. Cloquet. It is liable to happen in either stage of the operation; in opening the sac, or in dividing the stricture. The one occasion of accident may generally be avoided by observing the precautions enjoined, in opening the sac; and the other by equally protecting the gut, in dividing the stricture. The escape of flatus and fæces will at once declare the nature of the accident; although, of course, the same discharge occurs when the gut yields by laceration from handling it in a soft and gangrenous state.

The *treatment* of wounded intestine is simple. A puncture may be secured by seizing the point with forceps, and casting a fine silk ligature around it, the ends of which should be clipped off close. An incision may be closed by the glover's stitch. In either case, the bowel is then to be returned *just inside* the mouth of the sac. The case proceeds the same as

in a wound of the abdominal parietes involving the intestine; and result is not unfrequently successful, or the bowel giving way, an artificial anus forms.

Wound of an Artery.—In dividing the stricture, an artery may be wounded, either as a sheer accident, owing to some anomalous course of the vessel, or from dividing the stricture in a wrong direction. The accident is more liable to happen to the deep epigastric or the obturator arteries, in the operations for inguinal and femoral herniæ.

Treatment consists in at once cutting down upon and securing the bleeding vessel; an injunction easier given than carried out. As a caution against such an accident, I am accustomed to elevate the hand holding the hernia-knife, so as to divide or notch the stricture somewhat externally than internally—towards any possibly unusual relation of an arterial vessel; observing also to divide only to such a limited extent as may be requisite to return the hernial protrusion, when disengaged by gentle manipulation.

Inflammation and Suppuration of the sac has been known to follow herniotomy, in which the sac is opened. It is more liable to happen in the operation for scrotal hernia, the sac being of large size. In a few days the scrotum becomes distended and tender; and as these symptoms are accompanied with constipation and sickness, the Surgeon might suppose that the hernial protrusion had returned. He is soon undeceived by the escape of some purulent matter, which must then be allowed to have a free discharge, favoured by poulticing.

Sloughing of the Sac seldom occurs; it usually terminates fatally occasionally in recovery. I have only seen this complication once,—in an old inguinal hernia, with a thick sac, and of large size; the wound was opened, the sac sloughed, and the patient died.

TREATMENT AFTER OPERATION.—The general indications are to restore the healthy state of the intestine and omentum, and to prevent or manage inflammation supervening as peritonitis,—and as complicated with a penetrating wound of the abdomen and a reduced state of the constitutional powers, in consequence of continual vomiting, starvation, suffering and alarm.

Accordingly, the plan of treatment may be generally stated in the following order :—The patient is placed on his back in bed, and not disturbed by talkative friends; the intestine being left at rest for some days to recover itself. Soon after the operation, a full dose of opium—ten drops of the tincture—will be advisable. At this period, brandy-water may be given with advantage, in small quantities at intervals, as a stimulant; to recover the circulation from the state of prostration into which it collapses previous to the operation, and the effect of chloroform. The bowels will probably be relieved naturally within the first twenty-four hours. But if not, they may be allowed to remain inactive for three or four days, when a mild enema of gruel and castor oil, or salt and water will be sufficiently laxative. The state of the intestine at the time of the operation is the best guide. When the bowel is found to be highly congested, it should be left inactive for perhaps a week; the administration of an enema, to induce peristaltic action within that period, might be followed by fatal peritonitis, from bursting of the almost gangrenous intestine. The diet, light and unirritating, must be given in small quantities.

at short intervals, without loading the intestine. Thirst, often a distressing symptom, will be greatly allayed by sucking pieces of ice in the mouth.

Peritonitis supervening, is denoted by the usual symptoms of pain in the neck of the sac, spreading over the abdomen; this must be met by leeches, warm fomentations, and the ordinary treatment of peritoneal inflammation; in its acute and sthenic, or its chronic and asthenic forms. This plan of treatment must, therefore, be modified according to the opposite conditions of youth and age, strength and decrepitude, temperance and intemperance, and the peculiarities of the individual. I have known *peritonitis* after herniotomy to be attended with singularly persistent abdominal symptoms, such as tenderness and tympanitis, yet without any notable constitutional disturbance.

The wound may heal partially or entirely by primary adhesion. But if inflammation and suppuration ensue, the sutures should be withdrawn, here and there, to allow of the free escape of discharge. Healing then takes place by granulation and cicatrization. When the patient gets up, he should wear a *truss* for some time, to support the part as yet in a weakened state. It may be disused, when there is no tendency to protrusion on coughing or other exertion.

CONGENITAL HERNIA requires a special adaptation of the *reduction* treatment, and principally with reference to the situation of the testicle,—as found in the scrotum, or above the external abdominal ring, and perhaps in the abdomen. 1. When, as usual, the testicle has descended into the scrotum, the hernia may be reduced, and a *truss* applied; which should be worn for a considerable period, not less than two years, in the hope of inducing adhesion of the neck in the inguinal canal, and thus a permanent radical cure. Children, who are naturally restless, and in whom the hernial parts are small, may generally be fitted more conveniently and precisely, with an air-pad truss. 2. When the testicle has not descended, the hernia must be returned as often as it comes down; but *no truss* should be worn, lest it close the vaginal sheath of peritoneum and so preclude the descent of the testis.

Operation.—*Strangulated* congenital hernia will require an operation for its relief; and the urgency is greater even than in strangulation of ordinary oblique inguinal hernia, owing to the tighter constriction of the narrow neck, especially in adults. Attempts at reduction by *taxis*, therefore, should not be long continued, a few hours only being sufficient to induce strangulation and gangrene. The peculiarities met with in the operation are: that the *stricture* is almost always situated in the neck of the sac, which must be opened to divide it—and thus the extra-peritoneal mode of operation is ineligible; the narrow neck of peritoneum must always be divided in its *entire length*, from the external to the internal ring; the *sac* is the *tunica vaginalis*; it frequently contains a large quantity of serous fluid, clear or dark coloured, and the *testicle* at the bottom of the sac is in contact with the visceral protrusion, which may be both intestine and omentum, adherent frequently to the testis. Lastly, *division* of the *stricture* may always be directed *upwards* and *outwards* with safety; the hernia necessarily being oblique, and lying therefore external to the epigastric artery. After-treatment may present some difficulty in the application of a compress and bandage, owing perhaps to the situation of the *testis*—when *undescended*. If this organ be in the abdomen, pressure

must not be continued to obliterate the peritoneal communication; if it lies in the inguinal canal, it can perhaps be drawn down a little so as to apply the pad over the inner abdominal orifice. This operation is more fatal in its results than those of ordinary inguinal hernia. In eight cases by Professor Spence, there were four deaths.

In the *female*, the operation is precisely similar; the hernial descent taking place in the analogous vaginal process of peritoneum, known as the canal of Nuck, which ensheaths the round ligament of the uterus, as it passes down within the inguinal canal.

ENCYSTED HERNIA.—The operation presents the peculiarity of a *double sac*; an anterior one, the tunica vaginalis, enveloping the true peritoneal hernial sac. (See Fig. 116.) The former, therefore, is first opened, exposing a serous cavity, but no hernial contents; behind lies the hernial sac, invested externally by the glistening surface of the opened tunica vaginalis, the conjoined surfaces forming a double serous layer; the hernial tumour, with the testis attached below, is remarkably movable, and readily tumbles out through the aperture in the tunica vaginalis, as a pyriform mass, suspended only by its attachment to the margin of the external abdominal ring. Proceeding with the operation, the double serous layer is divided, thus opening the hernial sac; which contains, as in other hernia, intestine, omentum, or both. The *stricture* will usually be found at the *neck* of the sac; this is divided, and the operation completed by reducing the protrusion.

Radical Cure.—Of the various operations which have been devised, and practised, for the permanent cure of inguinal hernia, Gerdy's and Wurtzer's are simply *invagination* of the scrotal skin, and fascia, so as to form a plug up the hernial canal; Mr. Wood's operation is, in addition, *compression* of the boundaries of the inguinal canal, in its entire length, by subcutaneous ligature. Both these principles, and methods of operation, have fallen into disuse, or are now rarely practised.

CLOSURE OF THE NECK OF THE HERNIAL SAC, BY SUTURE—WITH EXCISION OF THE SAC.—*Suturing* the *neck* of the *sac*, or *hernial aperture*, with antiseptic catgut, fishing gut, carbolyzed Chinese silk, or silver wire, is the most effectual method of operation, which has been devised for the purpose of occlusion, in inguinal hernia. This method is advocated by Annandale, P. H. Watson, Czerny, Corley of Dublin, Rushton Parker, and others; in various modifications of the operation. With this suture method is conjoined, *Excision* of the *hernial sac*.

The *Conditions* of *Hernia*—including irreducible protrusions—which are most fitted for the operation of radical cure, are enumerated by Mr. Mitchell Banks; and the practical details to be observed are best described in his own words:—

"An operation should be recommended (a) in children only when it is impossible to get the parents to pay any attention to the complaint—in short, in the children of the poor and ignorant; (b) in small femoral hernia composed of irreducible omentum, always; (c) in inguinal hernia incapable of support by reason of the presence of adherent omentum, always; (d) in all hernia whose great size renders support by a truss impossible. Ventral and omental ruptures come in the same category as (c) and (d).

"**OPERATION.**—(1.) Before every operation for femoral or inguinal

is of the greatest importance that the pubes, scrotum, and the e of the thighs should be shaved, and carefully disinfected by washings with carbolized water. During the process of cutting on the sac, the very minutest vessels should be tied, and this most carefully done during the whole operation, so that, when comes to be opened, no blood may flow into the peritoneal cavity. A mistake in one's first operations is in thinking that the sac has shed long before it has. In this way two or three extensive are often made, and then, after all, another layer or two are By these strippings the cellular tissue is torn up, as a result ofoublesome sloughing and suppuration are apt to occur. At its rt the *sac* is always more or less *adherent* to the *tunica vaginalis* al hernia, and at that point requires very careful separation, other-tunica and its contained testicle are apt to be pulled bodily out rotum. As regards the structures of the *cord*, the only one about ere need be any anxiety is the *vas deferens*. Very early on in the f clearing the sac it ought to be found, and kept carefully in view e whole operation. Injury to the vessels or other constituents of does not seem to affect the testicle at all.

congenital inguinal herniæ, there is always much more difficulty ting the cord than in any other form, and in young children, in e peritoneal tube is very thin, it is most difficult. In congenital is necessary to divide the tube a little way above the testicle, so ke a *tunica vaginalis*, which ought to be stitched up with fine The rest of the tube is then stripped up to the ring, and tied and the usual manner.

Treatment of Omentum contained in the Sac.—When the sac has ected out, and the contained bowel pushed up into the abdomen, ften a strong temptation to ligature it at once without opening it. he sac should always be opened and examined, because, although feel absolutely certain that no bowel remains, there is often a very or fag end of flattened omentum lying just outside the ring, and around the neck of the sac. Now if this be cut across with the inner end still remains attached to the abdominal wall opposite the inguinal aperture and acts as a pioneer for more omentum and for come down. Concerning the *removal of omentum*, whether or not, not the slightest dread need be entertained of cutting y amount of it.

moving the Sac and stitching the Ring Pillars.—The *sac* having roughly separated and opened, and its contents having been of, it should be well *pulled down* and *tied* as *high* up as possible, at the femoral or at the inguinal apertures. The great object of e proceeding is to restore a uniform surface to the peritoneal wall, e the higher up the sac is tied the better is the chance of this rmanent. The movement of the bowels over the front of the al wall is, so to speak, a liquid movement. It is the searching a great wave slowly rushing up the face of a breakwater. Clearly, ever we may strengthen our bulwark behind by stitching up the applying a truss, the first thing to do is to keep its water surface—neal surface—free from any inviting pouch or depression. Indeed, se of femoral, umbilical, or ventral ruptures this is all we can do.

"Turning to the *pillars* of the *ring*, I employ two, three, or four *wire* sutures to pull them together, inserted with a curved needle and handle. Room must, of course, be left at the lower part of the ring for the spermatic cord to pass through. The wire should be thick enough so that a single knot on it will suffice to make it hold without any sewing or without twisting. Then it should be cut very close to the knot to leave no sharp projecting ends. In the few instances where a wire suture work its way out, this point had not been attended to and its sharp ends had irritated the tissues till they ejected it. The ends cut close off, it is simply a minute circle of silver, than which there is nothing less irritating. I adhere to the silver suture and recommend its use for the one reason that its hold is certain and beyond that of any other suture, while it is as harmless as any. It imbeds itself and is no more seen, except in the rarest instances where a great deal of suppuration has taken place.

(2.) "*Inguinal Hernia with Undescended Testicle.*—In those cases where the radical cure is undertaken for hernia coming down behind the undescended testicle, the latter ought always to be removed. Such a testicle may almost always be considered to be practically a useless organ, as it neither goes up nor down, and remains just outside the ring, effecting nothing but the venting the efficient action of a truss. I have done this in two cases, as the removal of the testicle and cord leaves nothing to come through the ring and so keep it patent, a really perfect cure, without the necessity of wearing a truss, may be expected in such cases.

(3.) "*Strangulated Hernia.*—As regards the application of the radical cure to cases of strangulated hernia, it is certain that in due time it will come to be considered as a necessary part of the operation, and sufficient help is obtainable. But there is no doubt that in the case of a large inguinal or umbilical hernia the stripping of the sac and the subsequent details of the radical cure involve a great amount of work, as compared with the simple process of opening the sac and turning the gut. Many a country Surgeon does herniotomy in such cases over again during the middle of the night, with a single assistant, and with the light of a couple of candles. Under such circumstances it cannot be expected that he should undertake an operation. But in hospital practice, or where there is plenty of light, the radical cure should always be undertaken, because, in addition to the venting further descent of the bowel, it renders herniotomy infinitely less dangerous."

Irreducible Hernia.—Inguino-scrotal hernia, when irreducible, attains a large size. It must be supported in a *bag-truss*, and is somewhat protected from injury.

Femoral or Crural Hernia.—**COURSE.**—This form of hernia protrusion descends vertically below Poupart's ligament, through the *ring* and *canal*; lying in the sheath of the femoral vessels, internal to the femoral vein. Emerging from beneath the sharp upper margin of the saphenous opening in the fascia lata—that portion known as the *cornu*, or the femoral ligament, of the falciform border or process of the *cornu*—the hernia comes forward, in front, through the opening, and then turns upon itself abruptly, upwards, towards Poupart's ligament,—thus covering the portion in the crural canal; so that the upper *cornu* of the *falciform*

and the crural sheath intervene between the superficial and deep of the hernial protrusion. This curved course of femoral hernia is important in relation to the direction of pressure necessary for it; it being requisite that the protrusion should be made to retrace its course, downwards, backwards, and upwards.

The position of vessels around the crural ring is specially important with reference to the direction in which the stricture of femoral hernia at that point may be most safely divided. Commonly, the ring is partially encircled by vessels; on the outer side, by the femoral vein, and at the angle by the epigastric artery; anteriorly, the pubic branch of the artery runs to the back of the pubes, and more removed from the aperture of the spermatic vessels of the cord. Thus, then, the ring is encircled by vessels, excepting internally and posteriorly. An abnormal origin of the external iliac artery may, however, give an additional vascular relation to the crural ring. Sometimes this artery arises from, or with, the (deep) epigastric, and its course to the notch in the obturator foramen, it may have either positions relative to the crural ring; passing down more frequently on the outer side, or arching over and down on the inner side, at the Gimbernat's ligament, an occasional course which occurs once in fifty operations. (Lawrence.) In the one position, the inner side of the ring is still free from any vessel; in the other, it is then completely encircled with vessels, except posteriorly in its relation to the pubes.

A small *pubic branch* from the epigastric, which runs to the back of the pubes, may perhaps pass downwards near the inner side of the crural ring, and anastomose with the branch from the opposite side; or a similar branch descending on the inner side of the crural ring, may join the trunk of the external iliac artery; or again, the *epigastric* artery, having its unusual origin at the obturator, or from the femoral artery, may, it is said, ascend under the crural ring on the inner side of the ring.

OF STRICTURE.—The strangulation of femoral hernia may be effected either at the *crural ring*, and caused by the *base of Gimbernat's ligament*, or with perhaps the margin of the conjoined tendon, internally, and the *pubic ligament* with the band of the deep crural arch, in front; or, at the *margin of the saphenous opening*, and caused by the falciform border, or *cornu* in particular as it arches over the hernia escaping from the ring.

Thickened bands of *fascia propria*, situated about half an inch below the crural ring, across the neck of the sac, may also be an occasion of stricture; so as to constrict and indent the neck.

VARIETIES of femoral hernia, characterized by the course of the sac, are here noticed, as being rare and curious.—(1.) *Crural hernia*, in which the sac is *external to, the femoral vessels*. (2.) *Pectineal crural hernia*.—This variety of hernia, as soon as it traverses the crural ring, passes directly internal to the femoral vessels, and rests on the pectineus muscle, the basis of which may form an envelope to it. (3.) *Crural hernia, behind Gimbernat's ligament*.—This variety is situated internal to the femoral vessels, but it passes directly through the resisting Gimbernat's ligament. (4.) *Crural hernia, with a diverticulum through the cribriform fascia*.—The hernia traverses several openings in the cribriform fascia, and forms several distinct lobes, which give it a very characteristic appearance. (5.) *Crural hernia, with a diverticulum through the superficial*

fascia.—A variety in which the hernia, having escaped beneath the ligament and traversed the cribriform fascia, sends one or more projections through the superficial fascia.

SIGNS.—The tumour of femoral hernia presents certain characters. It is situated *below Poupart's ligament* by about half the length of the crural canal, and to the inner side of the vessels, but *external* to the *spinous process* of the pubes. These have reference to the *neck* of the tumour, and femoral hernia is distinguished from inguinal, whether this be a bubonocoele or scrotum. At first the swelling is generally of *small size*,—not larger perhaps than a Spanish nut or walnut; but it may soon increase to the size of a fist, and rarely attains to much larger dimensions, although possibly the size of inguinal hernia. The shape of the tumour is tolerably round, and it *extends upwards* to Poupart's ligament, assuming a *triangular*

FIG. 120.*



elongated form; rarely, it overcomes the femoral vessels externally, and passes upwards upon the thigh (Fig. 120). The *consistence*, the *hernial tumour's* course vary with the contents of the sac,—as to the presence of intestine, or both,—an entero-epiplocele; the quantity of serous fluid in the sac affects its tension. But the size of the *trusion* also renders it harder or softer. In a small hernia, particularly a knuckle-like, deeply seated in the angle between the body of the pubes and the femur, it forms a tense unyielding lump, scarcely visible, and feeling like an enlarged lymphatic gland; while a fully developed hemispherical hernia has a soft, fluctuating consistence. The *reducibility* of the tumour, and its varying size according to posture, straining or coughing, and the impulse then communicated, are all additional signs of its hernial nature.

Females are much more subject to crural hernia than males. This greater liability may be owing to the larger size of the crural canal in the female. The relation of femoral hernia to *age*, in the female, is very remarkable, and explains the numerical equality of the two forms of hernia. Before puberty, inguinal hernia is common, whilst crural is extremely rare.

After twenty years of age, crural hernia is much more common than inguinal, and it occurs most frequently between the ages of twenty and forty—*i.e.* during the prime of life in women. The liability is due to that being the period of life when parturition is a frequent occurrence, whereby the abdominal walls become much stretched and weakened.

DIAGNOSIS FROM OTHER TUMOURS, IN THE FEMORAL REGION.—An abscess differs from femoral hernia, in its situation, the character of the tumour, and its history. The abscess presents below Poupart's ligament, but to the *outer* side of the femoral vessels. It is partly at least reducible in the recumbent posture; but careful palpation with either hand, especially above and below Poupart's ligament, demonstrates a *corro-*

* Roy. Coll. Surg. Mus.

absidence and enlargement in these situations, as of fluid passing to and fro. The antecedent symptoms of pain in some part of the dorsal or lumbar spine, and constitutional disturbance, will corroborate the diagnosis; any impulse on coughing notwithstanding. 2. *Iliac* abscess may point at the crural ring, but the history and constitutional cachexia will be diagnostic, although associated with impulse on coughing, and a reducible swelling. 3. *Cysts* occasionally form in the neighbourhood of the crural ring, and associated with hernia, or existing alone. The fluctuation on pressure, with persistence of the swelling and its invariable size, will mainly determine the nature of the case. 4. *Venous dilatation*, or a *varix*, may occur at the saphenous opening. Any such enlargement is reducible like hernia, but pressure above will cause the swelling to be reproduced. The characters of varix are also marked, as to the thrill and murmur, and the varicose enlargement of the vein below the crural tumour. 5. *Enlarged crural lymphatic glands* may be distinguished from hernia, by the aggregated character of the swelling, its persistence on pressure, and by the absence of any impulse on coughing. The history of the case will also be corroborative. An omental hernia, presenting a somewhat irregular swelling, and having an obscure impulse, most nearly resembles an enlargement of these glands; but they may then be distinguished by the mobility of the tumour, which can be drawn away, or lifted up from the crural ring. A single enlarged gland, situated over or in the ring, offers the most difficult diagnosis. But although the little glandular swelling may be tender or painful, the symptoms of strangulation do not ensue. 6. *Fatty tumour*, of small size, and situated in the crural canal, has occasionally been met with. It closely simulates hernia. The soft and doughy character of this growth contrasts with the tense consistence of crural hernia, similarly placed; the irreducible character of the swelling, and the absence of impulse on coughing, are also distinctive.

The co-existence of any femoral tumour or swelling with femoral hernia renders the diagnosis more or less difficult. And especially if the hernia be of small size, and concealed by the tumour. Thus, enlarged and suppurating femoral glands, overlying a small hernial protrusion, may simulate strangulation. But the main points of distinction are the history of such enlargement, with the co-existence of any cause of lymphatic irritation; coupled with the absence of constipation and vomiting.

TREATMENT.—This must have reference to the state of the hernia; as reducible, strangulated, or irreducible.

REDUCIBLE FEMORAL HERNIA must be treated in the usual manner; the protrusion returned by taxis into the abdomen, under the influence of chloroform, and a proper truss applied, and worn, over the crural aperture. The direction in which manipulative compression should be made is especially important. Remembering the course of femoral hernia, a fully developed protrusion should be returned by gentle pressure, downwards from Poupart's ligament, in order that it may turn the sharp upper corner of the falciform border of the saphenous opening, then directly backwards as if into the thigh, and upwards, through the crural canal. In short, the hernia is unfolded as it were, and made to retrace its course into the abdomen. During this manipulative proceeding, the Surgeon should avail himself of a relaxed state of the saphenous opening, by flexing and rotating the thigh inwards.

in the treatment of crural hernia; namely, the difficulty often in the reduction of small recently developed enterocele, the progressive injury to the bowel, and the severity of the constitutional symptoms. The hernia may become strangulated and recognized descent. Hence the Surgeon should always watch for a hernial tumour, however unsuspected by the patient. Redness, pain, and symptoms of strangulation being persistent, and the division of the stricture and liberation of the hernial protrusion being had recourse to, as soon as possible. This rule of early operation is even more imperative in femoral than in inguinal hernia; the tight and unyielding character of the stricture in the former delay would be the more dangerous.

OPERATION.—The stricture may be divided *external* to the protrusion returned without opening the sac, and this limited operation is sometimes effectual; when *internal*, it will become necessary to open the sac, in order to divide the stricture from within.

FIG. 121.



sac, in order to divide the stricture from within. The patient lying on his back, chloroform has been administered, the trachea is exposed, and the bladder is pushed up and transfixed with a skin, transverse incision is made on its upper surface, and inclining downwards to reach the stricture (Fig. 121). If the stricture is opened, the operation is thus completed, plus a slight

liately underneath the fascia; in the other, the sac is buried within its stance. But, however this fascia may resemble the peritoneal sac, it be distinguished by observing that the one is continuous with the gin of the hernial aperture, whereas the other is there defined, and strictured by it. Passing the finger up on the neck of the tumour, the *upper margin* of the saphenous opening in the fascia lata will be felt stricturing the neck; and immediately behind this, the *junction* of Pott's ligament with the base of Gimbernat's ligament may also be the seat of stricture. These strictures should be divided successively; first, the *inferior border* at its upper cornu, in order to find the necessity for proceeding a little more deeply to Gimbernat's ligament. Introducing a *hernia-knife* along the curve of the finger, or on a curved director, or *resting* its point between these ligamentous constricting bands and neck of the tumour, just to within the crural ring, this double stricture be overcome by dividing it *upwards and inwards*—on thus obliquely *directing* the cutting portion of the knife. It yields with the usual creak-sound and sensation; and a very limited extent of incision will prove sufficient. Having divided one or both strictures, the hernia may not frequently be reduced, without opening the sac, by gently compressing contents. Sometimes, however, another source of stricture still exists, in the form of *thickened bands* of fascia propria, situated about half an inch *below* the crural ring, across the neck of the sac, constricting and indenting it. These should be divided, by insinuating the nail of the finger underneath from above, and carrying the point of a probed bistoury along the neck, with its blunt edge towards the sac.

But if this fails to liberate the hernia, or if the *symptoms of strangulation* have become thoroughly established, even to stercoraceous vomiting, the visceral protrusion may have suffered also by prolonged taxis, it then be necessary to proceed to lay open the sac. The *fascia propria* must first be divided carefully on a director. When thin and membranous, the sac is at once exposed; when thick and fatty, and perhaps cystic, this must be done cautiously, by making more than one layer with the knife on a director, lest the sac be inadvertently opened and its visceral contents wounded. On the other hand, it must be observed not to make a sac out of the artificial layers of the fascia propria, and then, mistaking the sac for intestine, not to open the hernial sac at all. This latter sac, having been fairly exposed, it is opened in the usual manner; a small *key-hole* incision being made by means of the forceps and knife used *inwards*, and the aperture enlarged on the broad director, upwards and inwards; the seat of stricture is then sought for, commonly at the *thickened* peritoneal mouth of the sac, and this must be divided *upwards and inwards*, as being the direction of least risk to any vessel adjacent to the crural ring. Sometimes, the ligamentous or fibrous structures external to the neck of the sac having been divided, the mouth of the sac can be sufficiently dilated by gently introducing the point of the finger, without further use of the hernia-knife. The contents of the sac and any adhesions are then dealt with according to the rules already given, with regard to inguinal hernia. An entero-epiplocele is usually found; and omentum lies mostly in front, enclosing and concealing a knuckle of intestine.

Hæmorrhage, perhaps considerable and persistent, is liable to occur in

dividing the stricture at the crural ring. This accident is peculiar to femoral hernia, and it has led to a fatal result occasionally, in addition to the ordinary hernial contingency of peritonitis. The bleeding proceeds from the obturator artery, that vessel having its unusual origin from the epigastric artery, and the more unusual course of then arching over the ring and descending on the inner side at the base of Gimbernat's ligament. This vessel will then be across the knife in dividing the stricture upwards and inwards. Sometimes, the small pubic branch from the epigastric, running to the back of the pubes, passes downwards near the inner side of the ring to anastomose with the branch from the opposite side; or again, the epigastric artery, having its unusual origin from the obturator, or from the femoral artery, may ascend on the inner side of the ring. The same liability to hæmorrhage would then occur, in dividing the stricture at the crural ring. Any such unusual source of hæmorrhage it will be difficult to anticipate or control. Before introducing the hernia-knife, it might be practicable to feel the pulsation of the aberrant artery with the tip of the finger. When cut, the vessel may perhaps be drawn to the aperture and *tied, or twisted* at both ends; or the hæmorrhage may be arrested by plugging with lint or sponge, and by cold applications. Secondary hæmorrhage will necessitate a fair exposure of the vessel, by cutting down in the course of the hæmorrhage, and tying whatever vessel bleeds. Occasionally, an artery bleeds which at the time of operation did not; it will then be scarcely justifiable to cut down and explore for an unknown source of hæmorrhage, and the only expedient is a cold application.

A compress and spica-bandage must be applied, to prevent the recurrence of protrusion.

A too free division of the stricture at the crural ring, unattended with hæmorrhage, may be followed by an increased liability to hernial protrusion, after recovery from the operation. This result is owing to a weakened state of Poupart's and Gimbernat's ligaments at their angle of junction. The truss, worn eventually, will then require the additional support of a cross tongue, buckled on to its free end.

RADICAL CURE.—Little has hitherto been done to effect a radical cure of femoral hernia by operative procedures. But the same principle of operation, as for inguinal hernia—by *suturing the neck* of the sac, and then *excising* the body of the sac, is here applicable.

Irreducible Hernia.—Crural epiplocele very often becomes irreducible, but enterocele in this state is equally rare. The tumour may attain to large dimensions, equalling in size a large scrotal hernia, and losing the appearance of femoral hernia. No other treatment can be pursued than to support and protect the hernial protrusion by a truss with a *hollow pad*; and this whether it be epiplocele or enterocele.

Umbilical Hernia.—*Exomphalos* or *Omphalocèle*, as umbilical hernia is also sometimes called, signifies a visceral protrusion through the umbilical aperture; in common language, ruptured navel. The *course* of the protrusion, in this kind of hernia, is straight through the abdominal wall.

The hernial sac is always an acquired extension of the peritoneum, there being no process analogous to the inguinal vaginal process of this membrane. Yet umbilical hernia is sometimes described as of two varieties: the *congenital*, with reference to its formation in infants from birth; and the acquired variety, which is developed in *adults*. In the one condition

of hernia, the protrusion passes through the umbilical aperture, either before the cord is detached, or before that aperture has closed; in the condition of later or adult life, an aperture is formed by a separation of the fibres of the linea alba at the formerly closed umbilical ring or an immediately adjoining part, in consequence of its having stretched or yielded before the protrusion from within.

When *congenital*—existing at the time of birth—the hernia is formed by a dilatation of the umbilical cord, the protrusion separating the constituent vessels of the cord, so that the umbilical vein lies above, and the arteries on one side or below. This dilated portion of the cord contains a peritoneal pouch, enclosing usually a knuckle of small intestine.

The *stricture* in this kind of hernia, is the firm margin of the *umbilical ring*. Rarely, the sac having given way, the extruded bowel or omentum has become strangulated in the *peritoneal aperture*.

Certain *Signs* in connection with the tumour are characteristic. The hernia commences as a *small, soft, projecting ovoid swelling*, at the navel. It gives a distinct impulse on coughing, but is readily reducible by gentle pressure with the finger; and a small aperture is then felt, having a firm sharp border. On removing the finger, the skin remains relaxed and creased in the fossa of the navel; or it unfolds and distends, until the tumour reappears as before. As the hernial protrusion *increases*, the *tumour* assumes other forms, according to the anatomical relations of the umbilical aperture, in point of its size and position with regard to the protrusion. Hence a pendulous tumour is presented, semilunar transversely, or pyriform, with the *aperture* towards its *upper part*; or a round, flattened, and sessile, or nearly stalkless tumour. In the *congenital* form of umbilical hernia, the tumour consisting of a dilated portion of the cord, it may be recognized by its *smooth, translucent* appearance, the skin around the base of the swelling not being prolonged over the cord. The *base* of the tumour corresponds with the *umbilical aperture*; from the *apex* the *cord* is continued.

Umbilical hernia often attains a *large size*, and an *irregular shape* as if consisting of several tumours, owing probably to the yielding of its fascial or tendinous coverings at different parts; it has also a partly doughy and tympanitic consistence, according to the visceral nature of its contents. *Lumps* of *feculent* matter are apt to accumulate in the intestine when protruded, and which can be readily felt through the thin sac and lax abdominal coverings. Accordingly, the patient often suffers from dyspeptic symptoms and constipation. But the mechanical inconvenience of a large umbilical protrusion is an additional source of distress to the person thus afflicted. The tumour hanging down perhaps to the pubes, any exertion becomes burdensome, and the thin skin which encloses the mass readily excoriates. When *adhesions* to the sac have taken place, the tumour is proportionately *irreducible*.

This kind of hernia occurs mostly in *infancy*, at birth before the cord is detached, or before the umbilical aperture has closed; or in adult life, and indeed at any period of life; and in both sexes. *Females* are most liable, and especially those who have borne many children, or have a tendency to abdominal obesity. Ascites is sometimes attended with an umbilical protrusion, but which contains only the fluid of dropsy.

The immediate *cause*, as in other herniæ, is some straining effort of the

portion of the protrusion rests. At the same time, the anus should be relaxed by flexing the thighs towards the belly, and elevating the chest; although this position of the patient is more than in other herniæ, as the resistance is principally due to the character of the umbilical aperture, and the abdomen is pendulous. Some time may be required to return the protrusion, often of large size; and owing to the nature of its contents, it necessary to knead back into the abdomen masses of feculation, before the bowel could be returned, followed by easy reduction, the Surgeon proceeds to close the umbilical aperture with a properly adapted *truss*. In *infancy*, an elastic india-rubber air-pad, affords the most effectual support; or a simple ready contrivance is a slice of cork covered with leather, secured by a firm, flat compress over, not in, the aperture, and retained by a piece of adhesive plaster. Thus supported, the aperture yields to its natural tendency to close, in two or three months. In *adults*, a similar truss must be worn, made on the same principle as for *infancy*.

The *radical cure* by operation would consist in *suturing* the sac, and also transfixing the margin of the *tendinous* hernial aperture; and then *excising* the sac. Recovery has followed the hernial protrusion has not recurred in some cases. It has shown that ligature of the sac of peritoneum often causes strangulation as if the intestine were involved. The mere closure of the sac would be useless.

Considering the strong tendency to a natural cure, in *infancy*, the abdominal aperture is properly supported and for a sufficient time it will always be a serious question whether any cutting operation is justifiable at that period of life.

IRREDUCIBLE umbilical hernia must be treated on the same principle of support and protection by means of a *bag-truss*, or a *child* padded which I have known to afford great relief.

hours. On the other hand, the symptoms of true *strangulation* are very *insidious* in umbilical hernia, especially when the tumour is old-standing and irreducible. Consequently, timely recourse to operation must not be overlooked.

The operation itself is very simple. An *incision* in the middle line over the *upper part* of the neck of the tumour, and to about two inches in extent, will generally suffice to reach the constriction at the umbilical aperture. A longer incision, unless absolutely requisite, might allow of further protrusion, convolutions of intestine rolling out during each act of expiration. The constriction would thus be obscured, and the bowel liable to be punctured. This incision should be superficial,—passing through the skin only, and the fascial coverings should then be carefully divided—using a director, as the *sac* is soon reached; the finger-nail is inserted under the firm margin of the aperture, and the stricture slightly divided upwards, *without opening* the sac, and the hernia returned into the abdomen; or, if reduction cannot thus be effected, the sac must be *opened*, and the constriction divided within, upwards in the same line as the first incision. The omentum and bowel are then managed on general principles. Any other situation around the neck of the tumour may be selected for operation, when more convenient with regard to the position of the neck; and the stricture may be safely divided at any such point in the circumference of the umbilical aperture, there being no vessel fairly within the way of the knife in any direction. This operation has been performed during pregnancy, a complication not much affecting the case, and instances of successful results are recorded by Sir A. Cooper and Lawrence.

After the operation, under any circumstances, a large flat pad-compress must be applied over the hernial aperture, and retained in position by a broad flannel roller.

Ventral Hernia signifies a protrusion through any other part of the abdominal wall, except the apertures already noticed. Commonly, this hernia takes place at the *linea alba*, the *lineæ transversæ*, or more externally, at the *lineæ semilunares*. The *anatomy* of ventral hernia may be inferred from the particular part of the abdominal wall, which happens to yield; any such protrusion is usually the result of some lacerative or rupturing injury, favoured perhaps by some natural weakness, or over-distension of the abdominal wall. The *characters* of the *tumour* are similar to those of umbilical hernia, and the treatment is the same; but, as the hernial aperture is generally ill-defined and perhaps of some size, the broad, flat swelling can be more easily reduced, and seldom is followed by the symptoms of *strangulation*. Careful examination of the abdomen may be necessary to discover the protrusion when deeply imbedded in a *fat* person, for no tumour may then be perceptible on the surface. *Abscess* presenting in the abdominal wall, simulates a ventral protrusion.

Herniæ in other situations—as in the LUMBAR REGION, or through the OBTURATOR FORAMEN, PERINEAL, VAGINAL, PUDENDAL, ISCHIATIC, and DIAPHRAGMATIC, are very uncommon; and are fully described in the Author's larger "Surgery."

regard to youth, middle life, and old age. In *youth*; from intussusception by *bands* of lymph, omentum, or adherent *diverticula* of coils of bowel to each other, from *intussusception*, from taken by the mouth, from cancer rarely, and hitherto found only;—in *middle life*; from *volvulus* or *twists* of large or small intestine, from gall-stones, intestinal concretions, and foreign bodies, from *intussusception*, from *simple stricture*, from mesenteric hernia, from strangulation by bands, etc., from peritonitis often result from simple constipation, from *cancer*;—in *advanced life*; from *thickened intestine* the result of old reducible hernia, from *intussusception*, from simple stricture, and lastly, from intussusception.

Symptoms.—The *general* symptoms of intestinal obstruction are *pain* in the abdomen, and *localized* more especially in some point, with *abdominal distension*, *constipation* and *vomiting*, followed later by collapse. A *tumour* may, or may not, be present.

(1.) In the *acute form* of these symptoms, *intussusception* of the bowel, at some part of the intestinal canal, the common cause of obstruction, will illustrate their usual course. A portion of intestine slips into the lower, at the seat of obstruction. The patient is seized with *abdominal pain*, *sudden* and often referred to the seat of injury, perhaps the lower part of the abdomen. He seems conscious that something has happened within. *Flatulent swelling* supervenes, with much rumbling and gurgling in the intestines; a *commotion* which can be felt and perhaps seen at the seat of obstruction. That is the seat of obstruction, and there the commencement of a *tumour* may perhaps be felt, which continues to *elongate* in the direction of invagination. The lower portion of intestine, which ensheaths the invaginated portion, the consistence of this tumour is always *firm*, but it becomes more *firm* and increases in thickness, under manipulation and during a

ing, the patient's anxiety and distress are aggravated. At ration ensues, with some abatement of the symptoms, but of character; the victim sinks exhausted in a few days, usually *four or ten days* at the latest. Death is consequent on the coupled with gangrene and perhaps peritonitis. The *superficial gangrene* can hardly be determined; certainly not by the of hæmorrhage, or by the passing of blood-stained mucus; ing condition of the bowel being only perhaps that of

But the sudden occurrence of bleeding may be symptomatic of fatal termination. On the other hand, the *absence* of may be safely inferred when the tumour continues to advance in the direction of invagination towards the large intestine; movement for increasing involution being incompatible with attending gangrene.

Chronic obstruction, *stricture* of the bowel, and commonly of of the large intestine, as of the sigmoid flexure or of the attended with similar symptoms; but they are *less speedily* and *less marked*. Progressive inability to relieve the bowels, constricted, or flattened motions dwindling down at length on, with nausea and then vomiting less early stercoraceous, but by tympanitic distension and pain. *Death* may not occur *months*, and recovery takes place when least expected.

Diagnosis.—The *diagnosis* as to the particular *cause* of obstruction is positively determined by any known special symptoms, except where the seat of obstruction is low down, near or in the rectum. The condition or cause of obstruction is inferred from the greater *typicality* of the symptoms. In the *chronic* form of *intussusception*, for weeks or even months, the state of the intestine is that of *invagination*, rather than of strangulation; a simple invagination of the without adhesion or any marked interruption of the circulation. The invaginated bowel may be irreducible, and is very apt to become *inflamed*, and thus give rise to acute symptoms. But the causative *factor* is not so important practically, as its particular *seat*,—the intestinal canal affected. To discover this point, a most careful examination of the abdomen should be made externally; *palpation* internally as far as possible, through the passages,—the vagina in the case of a female patient.

Prognostic symptoms in the principal different *conditions*, *acute* may be thus stated. 1. In *intussusception*, the chief signs are *colic* pain and tympanitic distension of the abdomen, with bilious fluid or feculent matter, tenesmus, and the passage of *blood*; probably also the presence of a *hard, cylindrical, and sausage-shaped*—feeling like a long, thick sausage. Commonly situated in the descending colon, it may continue to advance in *invagination* is liable to some change of position. The *intussusception* is discovered by palpation, so as to displace the adjoining intestine being distended with flatus, may partly overlie the tumour, but also dulness on percussion may give place to tympanitic. Sometimes, an invaginated portion of bowel can be felt by *finger* up the *rectum*, or it may protrude from the anus. *Death* occurs usually at an early period of life, seldom in adults.

condition, below the obstruction; and the irritability of the intestine will allow more or less of the injection to be retained.

3. *Auscultation* of the colon and cæcum, while fluid is being injected per rectum, may clearly indicate the locality of obstruction in the large intestine; and this method of examination supplies the most reliable evidence respecting the question under consideration. On listening with the ear or the stethoscope, placed over the cæcum, the *fluid* thrown up the rectum can be heard *traversing* the large intestinal canal, and to stop at the cæcal reservoir; plainly demonstrating the absence of any impediment amounting to obstruction, in the flushing passage of the current. The rush of water may be heard all over the abdomen, if the fluid be thrown up the bowel too forcibly, and in a continued, gushing stream; but when injected more gradually, and interruptedly, the rushing sound is limited to the course of the colon. Any admixture of air, with the water, will obscure the character of the sound produced; and borborygmi in the intestinal canal must not be mistaken for obstruction,—for then the listening ear but listeneth to the murmur of the wind."

Peritonitis must be distinguished from intestinal obstruction; either when the peritoneal inflammation is associated with obstruction of the bowels, or when peritonitis occurs independently, and simulates that condition.

DIAGNOSIS.—(1.) Peritonitis, as a *complication* of intestinal obstruction, *supervenes* upon the symptoms of abdominal pain, vomiting and constipation, referable to stoppage of the bowels. The abdomen becomes tense and hard, as effusion of fluid takes place into the peritoneal cavity; giving also a *general distension* to the abdomen, unlike the one-sided sausage-like swelling due to intussusception. The collection of fluid may also be indicated by dulness on percussion, and fluctuation perceptible, in the flanks—as the most dependent parts of the abdomen. There is a notably increased tenderness of the tumid belly; while the previously intense pain may be mitigated, as intestinal paralysis ensues from peritoneal inflammation, and the peristaltic movements subside; the pain also becomes less paroxysmal, and more continuous. At the same time, the vomiting is sometimes aggravated, or it becomes less frequent; and its feculent character may cease, as the regurgitant action proceeds less from the intestinal canal. In the supervention of the symptoms of peritonitis, and the partial subsidence of the phenomena which had previously characterized obstruction of the intestine, the *combination* of both these conditions may be surely inferred. Whenever peritonitis has already developed, before a case of this mixed kind comes under observation, the *previous history* of the case, with regard to the order of the symptoms, will very much aid the diagnosis. In any case of peritonitis, the possibility of the peritoneal inflammation *masking* the symptoms referable, more particularly, to intestinal obstruction, must not be overlooked.

(2.) The diagnosis between peritonitis and intestinal obstruction, as an *independent* condition, proceeds upon the recognition of points of differentiation, to which Mr. Treves has specially drawn attention.

1. *Acute* peritonitis, resulting from *perforation* of the bowel—usually the cæcum or its appendix—closely simulates *acute* intestinal strangulation. In both the symptoms may develop suddenly, during apparent health, or after some *vague abdominal* disturbance; in both, early and

attack occurring quite suddenly, as a stoppage of the usual symptoms of pyrexia accompany the peritoneal inflammation, high temperature to 102° or 104° , but subsiding, perhaps subnormal, as prostration or collapse ensues, with perforation. With acute obstruction, the temperature is usually subnormal so throughout. (b.) Pain may be equally severe in both tory and the obstructive affections; but in the one, this is with notable tenderness on pressure over the whole abdomen, contrasting with the absence of tenderness, or the actual relief of pressure at the seat of strangulation. (c.) Vomiting may be an early symptom in both conditions, but its severity is more significant of acute strangulation, and it soon becomes, stercoraceous. (d.) Constipation is less absolute in acute than it is in acute obstruction. (e.) The abdominal wall has a characteristic tension and hardness in diffuse peritonitis, a general tumefaction of the abdomen; whereas, in acute strangulation, with perhaps a marked swelling at the seat of obstruction, characterizes acute strangulation,—until, with the supervening peritoneal inflammation, these features are exchanged for the general distension of the belly.

2. *Tubercular peritonitis* can scarcely be mistaken for obstruction of the bowels, when, as a *chronic* affection, the disease progresses to the ascitic condition of the abdomen, with general debility. But, in the early stage of tubercular peritoneal inflammation, the painful and distended state of the abdomen, associated with vomiting and constipation, constitute symptoms which bear a resemblance, so far, to acute obstruction of the bowels. Under these circumstances, abdominal section is proposed to relieve the supposed causative condition. But, in the end, and going, occasionally,—the fitful character of such attacks, has often misled the practitioner, and he has been thus deceived, and has thus perpetuated the illusion. From repeated attacks of tubercular peritonitis, intestinal obstruction may result, in consequence of adhesion.

obstruction, as the symptoms occur under circumstances which usually explain any difficulty in the diagnosis.

DIAGNOSIS.—(1.) As arising from some damage done to, or morbid condition of, a portion of intestine, *direct* paralysis of the bowel may be induced by *prolonged taxis* in the reduction of hernia—an enterocele; or result from *strangulation* itself, which paralyzes the peristaltic movement of the bowel, without obstructing the passage. Hence, the continuance of symptoms—constipation and vomiting, referable apparently to some obstructive cause. In other traumatic cases, as from a kick in the abdomen, the intestinal action may be directly paralyzed. *Peritonitis* sometimes feigns intestinal obstruction, in like manner, as the inflammation extends over the serous coat of the bowels. So also, diseases of or affecting the bowels, which result in *intestinal ulceration*, probably lead to a paralytic state of the muscular coat; and thus may be explained the constipation, and even vomiting, which sometimes ensues from typhoid, tuberculous, or dysenteric ulcers of the intestine; although diarrhœa has been a prominent abdominal symptom, in an early stage of such diseases.

(2.) *Reflex paralysis* of some portion of intestine simulates obstruction, not only in the production of constipation and vomiting, but in the collapse especially, which occurs in such cases. Thus a crush of the testicle, or inflammation of a retained testis, is soon followed by more or less severe collapse; and an abscess in the abdominal wall has the same effect, accompanied perhaps with colic, constipation, and vomiting.

(3.) As a manifestation of some *general* disturbance of the nervous system, symptoms of apparent intestinal obstruction may be referable to hysteria, meningitis, or other affections of the nervous centres.

Diseases simulating Obstruction of the Bowels may be noticed in connection with the question of *diagnosis*; but the *combination* of symptoms which gives to each such feigning disease its own individuality, removes it still further from association with a purely intestinal condition; although some symptoms may have an equivocal character, being common to both. Thus, it will suffice to mention lead-colic; arsenical poisoning; hepatic or renal colic; cirrhosis of the liver; tumours of the omentum, or of the mesentery, not implicating intestine; dysentery, or enteritis,—which, as inflammatory affections of the bowels, may result in constipation, and other symptoms of intestinal obstruction. That these sources of deception in diagnosis are worthy of record, is attested by the fact that, in all such cases, instances of mistaken identity have occurred.

URINE.—A marked *diminution in the quantity of urine excreted* is a frequent symptom in connection with *intestinal obstruction*. This anuria or oliguria is not significant of obstruction high up in the intestinal canal, but is proportionate to the *acute* character of the obstruction. It is symptomatic of the shock or collapse which attends such an attack, and occurs also in hepatic colic, and from severe abdominal injury. It is often associated with intense thirst. In *chronic* and incomplete obstruction, this urinary symptom, according to Leichtenstern, is indicative of the high situation of the occlusion, in the intestinal canal; stenosis of the duodenum being attended with marked anuria, as compared with the secretion of urine when the lower portion of the ileum or the colon is occluded.

Treatment.—The general indication of treatment in intestinal obstruction—first whatever cause oblige—is obvious enough; namely, to restore the continuity, and the normal action of the bowel. But how to accomplish this object is always a question of difficulty. Its rational fulfillment would first imply the previous restoration of the causative condition, a question—a topic not treated yet. This provision of diagnosis cannot, as yet have been, generally is attained.

General Means of Treatment.—Medical measures have regard to restoring the normal action of the bowel, and allaying the accompanying pain and inflammation, more particularly incident to acute obstruction. 1. With this view, the most important rule is never to administer purgatives; for, medicines by the mouth, to force evacuation through the obstructed portion of the intestinal canal. Stomachs may generally be used with advantage, all repeated and copiously, especially if the obstruction is apparently the result of congestion. Mild enemata are most serviceable, as soap and water, or simply of warm water; their mechanical movement being more efficient than any spasmotic action. The injection of air or inflation, by means of the stomach-pump, has occasionally proved efficient in overcoming the obstruction, and thus restoring the normal action of the bowel. But I prefer an oleaginous injection, which both distends the intestines, and acts as a solvent of any hard scybala or fecal accumulations. I have thrown in seven grains of olive-oil. As the intestinal canal becomes inflated, something is felt to give way suddenly, and a motion set follows. This practice has been most successful in Intussusceptions, as occurring in infants and children. When an invaginated portion of intestine has descended through the colon to within reach from the rectum, leeches have been used to push back the bowel; but this mode of treatment cannot be recommended either for its safety or success. Inversion and shaking of the patient's body might be tried; the legs being lifted over the shoulders of him who thus exercises his skill, and an anæsthetic having been given to relax all muscular action. Such a procedure is attended with the risk of doing some internal damage, or without much hope of effecting reduction. Aspiration has been resorted to, and with success, in some cases. A fine aspirating needle is passed into the most resonant part, and the fæces withdrawn. But the need is very apt to become impacted with feculent matter; and there is some risk of fecal extravasation in withdrawing the needle through the peritoneal cavity. 2. *Opium* is the most efficacious agent for the relief of pain, and it exercises some remedial influence on peritoneal inflammation. So with symptoms of peritonitis, calomel may be combined with opium; oil leeches, followed by hot fomentations, should be applied to the abdomen. *Solid food*, of any kind or in the smallest quantity, must be rigorously prohibited; the patient should be supported entirely by the inhalation of fluid nourishment; and this injunction is scarcely less applicable if the obstruction has yielded, and the bowel lies as yet disorganized or functionally paralyzed.

These general directions—as to treatment, should be modified according to circumstances; and chiefly with reference to the acute or slow character of the obstruction; the seat of obstruction, and the causative condition—so far as these factors in the question can be determined—being also taken into account.

(1.) In *acute* intestinal obstruction, the administration of *purgatives* would obviously increase the stoppage; when arising from *intussusception* or *volvulus*, any increased peristaltic movements of the bowels having the effect of aiding invagination or probably of twisting a *volvulus* tighter. It is only in cases of *fæcal impaction* that gentle laxative aperients may succeed in overcoming the obstruction. Castor oil is the most efficacious laxative, acting also mechanically as a solvent of any hardened fæcal lumps. *Enemata*—as aperients—are of use only when the obstruction is seated somewhere in the large intestine, and due to fæcal accumulations. Thus, the fæces collecting above a stricture of the colon may be reached by a soap or oil enema, when no passage could be effected from above the stenosis. Copious enemata may succeed in mechanically overcoming an obstruction, as by dislodging a fæcal impaction, or by reducing an invagination of the large intestine; but any such enema must be administered with some force—as a “forcible enema,” or “monster clyster,” thrown in slowly and gradually, and allowed to remain in the colon for some time. Chloroform may aid its operation on the gut. *Opium* is the most beneficial agent in the treatment of acute intestinal obstruction, arising from any cause, and as affecting any portion of the intestine—large or small. *Opium* subdues peristaltic action and vomiting, relieves pain, and counteracts shock; restoring also the pulse and temperature. The hypodermic injection of morphia often proves most salutary as a diuretic. In the repeated use of opium, however, it must not be forgotten that this remedy soon masks the symptoms of the disease; so that the patient may appear almost free from any intestinal obstruction, when he is really dying from acute strangulation. *Feeding* the patient is, of course, a most important consideration, to sustain the sufferer during the dread exhaustion, which so soon ensues from acute obstruction, and which speedily proves fatal. With incessant vomiting, the stomach cannot be expected to retain food. But, vomiting is most irrepressible when the *small intestine* is obstructed, leaving the colon a free passage. Then, nutritive enemata can be administered, in small and repeated doses of nourishment, consisting of peptonized or predigested food, and water to assuage the parching thirst. When, on the other hand, the *large intestine* is the seat of obstruction, vomiting is not only less severe, but the constant straining tenesmus would reject the introduction of food through the rectum. Then, however, it can be given through the mouth. Thus, the portal for the administration of nourishment will be selected, as the symptoms may indicate.

(2.) In *chronic* intestinal obstruction, similar considerations should guide the Surgeon. *Mild aperients* are not only harmless, but often most serviceable. In cases of *chronic intussusception* of the large intestine, oleaginous laxatives may be given with great advantage, from time to time; and fæcal accumulations, as the cause of stoppage, may thus be dislodged, dissolved, and evacuated. *Enemata* are likewise useful; and especially when the obstruction is low down in the course of the colon. *Opium* is a beneficial adjunct in the treatment; allaying pain, and distress. After the symptoms have continued for several days, or even for a period of weeks' duration, the source of obstruction—whatever it was—has yielded; and the sickness ceasing, with a spontaneous action of the bowels, this sudden relief has at once brought the patient out of his former precarious condition. *Feeding* is a most important element in the

management of any chronic stoppage of the bowels. When the *small intestine* is affected, and especially in the form of stricture, fluid nourishment may be taken, even by the mouth, without disturbing the bowel. In chronic stricture of the *colon* also, the importance of dieting will be obvious; not only with regard to the selection of easily assimilated food, but also with the view of not loading the bowel with indigestible, solid matter. Thus, the patient may be carried through the long period of exhaustion, consequent on attacks of vomiting and abdominal pain, the loss of food, and the imperfect absorption of nutriment by the damaged intestine.

Other methods of treatment, which are seldom practised, may be here referred to. *Ice*—taken by the mouth, or in the form of iced-water enema—seems to have some effect, occasionally, in subduing the symptoms of acute obstruction.

ELECTRICITY has overcome intestinal obstruction in some cases arising from the impaction of fecal accumulations, and where, therefore, the bowel is paralyzed. The galvanic current transmitted through the abdomen operates by exciting peristaltic action. Faradization has always been employed.

MASSAGE, or kneading the abdomen, would seem to offer some aid in similar cases; a stoppage of the bowels depending on the lodgment of fecal matter, gall-stones, or other foreign bodies. But this method of dispelling any such obstruction, can hardly be of any use in unshedding an invaginated intestine; and in acute strangulation, it would obviously be intolerable, and most damaging to the bowel.

Operations.—When medicinal treatment has failed, the question of operative interference arises. The period of obstruction when such surgical intervention becomes warrantable, cannot be determined absolutely. As a *general* rule, recourse should be had to operation after three or four days have passed, without any relief from ordinary measures, constipation being complete and stercoraceous vomiting persistent. Constipation alone will not justify operative interference, unless the obstruction be complete; but, with vomiting as a symptom of internal strangulation, an operation is the only alternative between probable life and certain death. Intussusception may be taken as an exception, owing to the pathological condition of the invaginated portion of intestine, with the probability of sloughing and separation of that portion of the bowel.

(1.) When the symptoms of strangulation are recent and *acute*, and other measures have failed to effect reduction, as ascertained by the disappearance of the tumour in the abdomen, as well as by the cessation of the symptoms, operation should be resorted to, without further delay. At a later period of intussusception, when the symptoms are bordering on collapse, operative interference will be comparatively useless, and it is better to trust to the chance of sloughing of the bowel. This twofold rule as to the time and state appropriate for operation, is even more imperative with regard to infants, who soon sink, and in whom gangrene too seldom happens, to offer a hope of recovery in that way.

(2.) In the more *chronic* form of intussusception, with scarcely any constipation or sickness, there will be little probability of gangrene occurring, as the natural mode of cure; but operation is even more justifiable, although not so urgent, as for acute intussusception,—the object

here being the removal of an otherwise persistent condition, and to avert the inevitable tendency to death from exhaustion.

METHODS OF OPERATION.—An operation for the relief of intestinal obstruction will vary in its situation and design according to the seat and nature of the obstruction.

(1.) In respect to the *small* intestine, the abdominal wall, and thence the peritoneum, must necessarily be opened, in order to reach the seat of obstruction. Thus may be relieved; obstruction of a hernial character,—whether depending on a constricting band, or the gripe of a fissure in the omentum or mesentery through which a coil of intestine has slipped; or a volvulus of the bowel may be untwisted. Least successful will be the operation in the following conditions:—when peritonitis has supervened from prolonged strangulation; in the obstruction from foreign bodies or calculi lodged in the bowel; and in stricture of any portion of the small intestine. Intussusception of either the small or large intestine, or involving both, will also be reached by the same operative procedure.

GASTROTOMY, LAPAROTOMY, OR THE ABDOMINAL SECTION, may be performed in the following manner. The arrangements resemble those of ovariectomy in the female. The temperature of the apartment should be raised to about 70° F., and flannels wrung out of warm water be at hand to protect the bowels; the bladder emptied, and chloroform administered. Then the Surgeon, standing conveniently between the legs of the patient recumbent, makes an incision, usually in the middle line below the umbilicus; or elsewhere, over the seat of obstruction, when that can be diagnosed by an intumescent tumour. Proceeding cautiously towards the peritoneum, this membrane is carefully slit up by a probe-pointed bistoury guarded by the forefinger beneath. Any protruding coils of inflated intestine are then to be gently drawn aside by an assistant using the wet flannels, while the operator searches carefully *upwards* along the empty coils of the bowel until he arrives at the *source of obstruction*. An *intussusception* must then be *reduced*. This may generally be effected by cautious and gradual traction of the ensheathing layer, instead of endeavouring to pull out the invaginated portion of gut. Sometimes, a start may be given to the reduction by gently compressing or kneading the ensheathed portion; and by following up this movement, it will perhaps glide out, leaving only the ensheathing part in the hand. A *constricting band* may be *divided* cautiously with the scalpel or broken through with the finger; a *portion of intestine* may be withdrawn from a *fissure* in the omentum or mesentery, or a *twisted* portion of *bowel* may be *untwisted*. In any case, having overcome the obstruction, the operator might be tempted to relieve the tympanitic distension, by pricking the adjoining intestine, but for the risk of some fecal extravasation taking place. When the bowel cannot be released, as a last resource, it might be opened as low down as possible, and the aperture stitched to the integument of the abdominal wound, with the hope of establishing an artificial anus. Otherwise, under ordinary circumstances, the bowels should be returned, and the abdominal incision closed by the interrupted wire suture, supported by an *antiseptic* compress and bandage. *After-treatment* must be conducted on the general principles relating to abdominal wound with peritonitis.

operation thus completed. This prevents the formation of intestinal obstruction—volvulus, stricture, and for obstruction arising from foreign substances. But the *object* and *circumstances*, are obvious. The operation is directed to the seat of obstruction, which may be above—the site of the artificial anus, or occasionally, between the opening above and below, leaves the patient practically unharmed. Therefore, will probably be a misadventure to operate higher up in the bowel, nourishment being denied, leading ultimately to exhaustion.

(2.) Obstruction of the *large* intestine, arising through the abdominal wall, in either the iliac or sigmoid region.

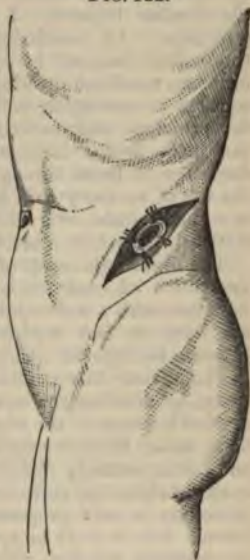
The *design* of any such operation is to remove the obstruction, commonly a stricture of the intestine; but to relieve constipation, and to restore the normal course, therefore, the bowel must be opened above the stricture. Hence, stricture of the rectum or sigmoid colon will necessitate an opening of the large intestine; in the case of the sigmoid flexure might be done by an opening of the transverse colon will require an opening of the *ascending colon*, or to the *cæcum*.

These four sites of operation have been chosen as to their respective eligibility for operation, with regard to not implicating the peritoneum, and pertaining to the sigmoid flexure at the iliac region, left or right, which must be wounded; whereas, in the case of the descending or ascending, the bowel can be opened without wounding the peritoneum, and the peritoneum can be closed.

COLOTOMY.—1. The operation

ds the Surgeon. The guide to the *incision* is the interval between rest of the ilium—its middle third—and the last false rib; and ay in this interval, external to the outer margin of the erector spinæ e. Or, the middle of the crest of the ilium may be determined by s of a tape drawn straight across from the anterior to the posterior or spinous process of the ilium; and from that mid-point, or not than one inch behind it, a vertical line, drawn upwards to the last coincides with the descending colon. Commencing midway in this al line, and just in front of the erector spinæ, an incision is carried rds transversely, or *obliquely* from above downwards—corresponding e middle third of the iliac crest, and to tent of from four to six inches. Of the

FIG. 122.



directions of incision, I prefer the latter (122). The muscular layers of the abdominal wall are then successively divided—two oblique muscles, external and internal, and which lying partly under cover of latissimus dorsi muscle, posteriorly, that le must be drawn backwards, or some of res may have to be divided. The *fascia crum*, or posterior aponeurotic tendon e transversalis abdominis muscle, is now ed—ensheathing the quadratus lum-a muscle. The wound being kept well with two curved retractors, one on either this fascia must be opened cautiously, lateral application of the knife, and divided on a broad director, upwards downwards. The last dorsal nerve and r will probably thus be cut, and then after should be secured with catgut. rather than work forwards towards the neum, the outer margin of the qua-s muscle had better be notched, in order in access to the gut. Clearing away llulo-adipose tissue, which is sometimes ranous and semi-transparent, looking he peritoneum, the *colon* presents itself, he more so if loaded; it appears at the bottom of the wound, and f peritoneum. It is recognized by its *muscular* character, somewhat in colour, and *distended sacculated* appearance; and the more fully it is engorged, the more freely will it have uncovered itself through upicature of the peritoneum—the meso-colon. If the colon cannot arly seen, it may be made to appear, by pressing on the outer side lumbar region, or by turning the patient backwards. The gut i be *hooked up* with a tenaculum, avoiding the peritoneum on either and drawn well out to the integument, to prevent any feculent n into the cellular texture, as the gut gradually collapses by dis- ing its contents when opened. Introduction of the finger into the might tear the peritoneum. A firm *ligature* is passed, by means ured needle, through the *integument* of the wound, and transversely

through the bowel, thence through the integument on the opposite side. Another ligature is passed, in like manner, lower down—in the longitudinal direction of the gut. A small aperture is then made with the scalpel, and there usually takes place a gush and copious flow of feculent fluid. Basins should be at hand to receive the abundant evacuation. The margin of the opening of the colon is then secured to the integumental incision, by dividing the ligatures—making *four sutures*. (See Fig. 122.) Other points of fine silver wire may be introduced to unite the skin and bowel more closely. An artificial anus thus formed may become established. Before this operation, should the colon not be distended by the retention of feculent matter, it will be desirable to inflate the gut by injection with warm water, that it may appear more prominently in the lumbar incision. I have experienced great advantage from this provision. In concluding the operation, the wound having been thoroughly cleansed by syringing with carbolic solution, a tannin pad forms an excellent dressing—antiseptic and absorbent. After-treatment consists in combating collapse and peritonitis. Opium and support are the principal constitutional requirements; and scrupulous cleanliness is the most urgent local observance to be attended to. The constant discharge of feces through the wound may generally be controlled by the use of an *ivory ball*, fitting the aperture in the bowel, and attached to a small shield, over which a soft thin piece of india-rubber should be fastened, the whole contrivance being retained in position by a bandage.

The immediate result of operation is to give great relief to the previous symptoms of obstruction above the seat of stricture. Subsequently, however, with a well-established artificial anus in the loin, the symptoms are more or less reproduced, in many cases, by fecal accumulation between the lumbar opening and the seat of obstruction below.

To obviate this condition, Madelung has proposed to modify the colotomy, by dividing the bowel. The operator *stitches the upper end* of the divided intestine to the edge of the abdominal wound, and so forms an artificial anus. He then empties the lower segment of the bowel of its contents and having entirely closed this divided end, reduces it into the abdominal cavity, behind the peritoneum, and closes the skin incision over it. This procedure is only proposed for cancer of the rectum, or of the sigmoid colon. But it could be applied to other conditions, affecting these parts. In cancerous stricture, the irritation of the surface by fecal matter is thus prevented; and also the tendency to prolapse of the gut at the seat of operation.

The only real difficulty in performing lumbar colotomy is when the gut is more or less concealed, owing to enlargement of the kidney downwards, as from cystic disease; and the only real danger is from fecal extravasation into the peritoneum, when the meso-colon is wounded—by knife, tenaculum, or needle, or this peritoneal reflexion is torn by the finger.

Paracentesis Abdominis.—In dropsy of the abdomen, whether ascites or ovarian, the peritoneal sac, or an ovarian cyst, becomes distended with fluid; and either cavity may be emptied of its contents by *Tapping*.

This is a very simple operation. The bladder having been emptied, the patient should be seated on the edge of a chair, or, if very weak, sideways to the edge of the bed; so that in either position the

protuberant belly shall be exposed. A flannel roller, or a jack-towel, the breadth of the abdomen from above downwards, is then passed round, and the ends, crossing behind the loins, are given in charge of an assistant on either side. They should draw the roller equably, to compress the abdomen uniformly, as the water flows. A small aperture is cut in the roller, corresponding to the point where the abdominal puncture is about to be made; namely, in the middle line, about two or three inches below the umbilicus. The Surgeon seating himself before the patient, as placed in the sitting posture, he makes a small vertical incision at the spot indicated, and through the integumental wound thus made, a large-size trocar and cannula is thrust into the abdomen. Or the thrust may be made at once, without any preparatory incision, the skin yielding without any appreciable damage to this texture. On withdrawing the trocar, taking care that the cannula do not slip out after it, the fluid spouts out in a full stream, and is received into a pail below. A convenient and more elegant arrangement is the adaptation to the cannula of a tube of india-rubber, provided with a stop-cock. The kind of fluid varies in colour and thickness; in ovarian dropsy, it is commonly of a brownish coffee-colour, turbid, and thick or of almost glutinous consistence between the thumb and finger, and it froths up as the stream continues. The assistants should draw the roller firmly, and especially as the stream weakens and dribbles, when air might pass back into the peritoneal cavity. Towards the last, the fluid may be tinged with blood, owing apparently to the mouth of the cannula impinging on the visceral layer of peritoneum. Then, unless by further traction the stream can be resumed, the cannula should be withdrawn. Sometimes the fluid suddenly ceases to flow, a bit of intestine coming in contact with the end of the cannula, or the tube being blocked up; in either case, the obstruction may be removed by introducing a piece of bougie or other blunt-pointed tube.

On withdrawing the cannula, a small strip of adhesive plaster will suffice to close the abdominal aperture. A broad flannel bandage should, however, be well applied round the abdomen to maintain compression; thus preventing faintness and the reaccumulation of fluid or recurrence of dropsy.

Tapping during *pregnancy* is an operative procedure, the propriety of which would appear to be questionable. But although sometimes followed by the premature birth of the child, it has in many instances been practised, even at the seventh or eighth month, without inducing miscarriage.

Accidental hæmorrhage happens occasionally in the operation of tapping the abdomen; arterial blood escapes through the cannula on being withdrawn beyond the abdominal cavity, or the patient turns faint subsequently from internal hæmorrhage. This arises, apparently, from a punctured wound of the epigastric artery. The source of hæmorrhage may, perhaps, be controlled by pressure; either by the introduction of a gum elastic bougie as a plug, or by means of a graduated compress over the cannula-aperture, or by compression, if the abdominal wall be loose and can be raised up in a fold. The artery might be ligatured or twisted, by an incision to reach the vessel; but this would not be a very easy or safe procedure.

Ovariectomy.—CONDITIONS FAVOURABLE AND UNFAVOURABLE FOR OVARIOTOMY, AND THE SELECTION OF CASES.—(1.) The probable result of Ovariectomy can be estimated with far greater accuracy by a knowledge of the *general condition* of the patient, than by the size and condition of the tumour. Some persons bear operations better than others. *Shock*, an unknown quantity, evades accurate estimation. Cases apparently the most simple sometimes succumb for no other assignable reason, and cases the most complicated and threatening recover. A large tumour, extensively adherent, in a patient whose heart and lungs and digestive and eliminative organs are healthy, and whose mind is well regulated, may be removed with a far greater probability of success, than a small non-adherent cyst from a patient anæmic, whose heart is feeble, whose assimilation and elimination are imperfect, or whose mind is too readily acted upon by either exciting or depressing causes. The now generally recognised rule is to remove an ovarian tumour as soon as possible after it is discovered—*early Ovariectomy*.

A patient carrying an ovarian tumour is liable to the following, amongst other dangers:—1. The tumour may *burst*; 2. it may twist on its pedicle, becoming *strangulated*; 3. it may be attacked by *inflammation* and *suppuration*. Since any one of these accidents may occur suddenly without warning, and prove fatal before surgical aid can be given, it is wise to anticipate them by early operation. Should such an accident occur, it is usually marked by *shock* and *collapse*, which may end fatally within twenty-four hours. Immediate operation under these circumstances has been successful in many cases, rescuing the subjects from imminent death. 4. Another complication may arise; that is, *pregnancy*. In such an event the accidents mentioned are rendered more probable; and although cases are not few in which the subject has gone the term of pregnancy and labour with impunity, the danger she runs by trusting to Nature is too great to justify expectation. Shall the Surgeon bring the pregnancy to an abrupt termination, and deal afterwards with the tumour, or remove the tumour, leaving the uterus undisturbed? Experience has pronounced in favour of *removing the tumour at once*. In a fair number of cases, the pregnancy has pursued its course safely.

(2.) *Age*.—Below the age of twenty, and between forty and fifty, the mortality is less than that between twenty and forty, or above fifty.

(3.) *Adhesions of the Tumour*.—1. Adhesions to the abdominal wall, omentum, or intestines appear to have little, if any, influence upon the mortality; so that the importance which has been attached to the *diagnosis of these adhesions* before operation has been very greatly and unnecessarily exaggerated. 2. But adhesions within the *pelvis*, to the bladder or rectum, or around the brim of the pelvis, are very significant; as they may be inseparable without great and immediate danger to life, by injury to these organs, to the iliac vessels, or the ureters. 3. Adhesions to the under surface of the *liver* or *spleen* are also of grave import. The diagnosis of *such adhesions* is of the utmost importance.

(4.) *Size of the tumour* has not, by itself, appeared to affect the result; but *size and solidity* together are important in so far as they affect the *length of incision* requisite for removal of the tumour.

(5.) *Influence of Tapping*.—As affecting the operation of Ovario-

tomy, the prior performance of Tapping has certain relations which may be thus indicated:—That one or manyappings do not considerably increase the mortality of ovariectomy. That tapping may be a useful prelude to the operation; either by giving time to the general health to improve, or by lessening the shock when the fluid is withdrawn a few days or hours before removing the more solid part of an ovarian tumour. But preliminary tapping is now rarely practised.

OPERATION.—The *Instruments* requisite for Ovariectomy are—scalpels, director, catch-forceps (Spencer Wells's) several, for bleeding vessels; a large trocar and cannula, and elastic tube; strong vulsellum-forceps; Paquelin's cautery; whipcord ligatures; strong nœvus-needles for carrying ligatures; silver-wire sutures; Keith's drainage-tubes; large and small fresh sponges, soaked in warm water, wrung out. The room should be raised in temperature to 70° or 75° F., and the patient remain if possible in the room after operation.

No special preparation of the patient is necessary; excepting that the bowels should have been opened by a gentle aperient of castor oil on the day previous to, and by an enema on the morning of, operation.

The application of Lister's *antiseptic method* to ovariectomy, at first warmly advocated, is now *not* generally performed under the *spray*. Of course, great care is taken to exclude all foul or septic contamination; the *sponges* are rigorously purified by soaking in a solution of carbolic acid; the *instruments* are placed in trays containing the solution—1-20. The operator, and assistant, wash their *hands* in carbolic solution—1-40.

Ovariectomy consists generally of the following seven steps or procedures in succession:—1. An incision in the middle line or linea alba between the umbilicus and pubes; 2. introduction of the fingers or hand into the peritoneal cavity to gently explore the situation, nature, and extent of any adhesions, in order to determine the practicability of completing the operation; 3. tapping the tumour, if cystic; 4. cautious separation of any recent adhesions; 5. securing the pedicle; 6. separation of the tumour from its pedicle, and removal of the tumour; 7. closure of the wound.

1. In carrying out these directions, certain *particulars* must be observed as essential to the probable success of the operation.

The patient lying recumbent, and ether having been administered, the bladder is emptied by a catheter. The skin of the abdomen is washed with carbolic solution—1-20. A towel, soaked in solution of that strength, is laid on *either side* of the abdomen. The Surgeon, standing on the patient's right side, makes an *incision* in the middle line or *linea alba*, commencing about two inches below the umbilicus and carried down to about four inches in length. Any small *bleeding vessels* are at once secured with catch-forceps. The abdominal wall being divided by a few horizontal touches of the knife, the peritoneal cavity is laid open. Care must be taken not to mistake the peritoneal membrane for the cyst-wall, and thus proceed to detach that membrane from the fascia transversalis; an error which has happened several times. The *peritoneum* having been opened sufficiently to introduce the finger, it should be *slightly raised* from the cyst to make certain of this fact, and then *laid open* on the finger or on a broad director.

A longer, or even a shorter, incision may be requisite, according to the size of the tumour, and the situation and extent of the adhesions. It is rarely necessary to have recourse to the long incision, extending from the sternum to the pubes. The wound may be extended upward or downward, as found desirable. This is best done by a strong pair of scissors, bent at a slight angle on the edge.

2. The fingers or the hand are now introduced into the peritoneal cavity, and the existence of adhesions ascertained, their situation, nature, and extent. They may be such as to determine the propriety of not completing the operation; the abdominal section would then have to be closed.

3. When, as usual, the operation is proceeded with, the tumour, if cystic, should be tapped, in order to more conveniently effect its removal, and through an abdominal aperture of smaller size than would otherwise be requisite. A large hollow trocar and cannula is thrust into the most prominent part of the tumour, and the fluid drawn off through the cannula. Especial care must be taken to prevent any of the ovarian fluid escaping into the abdominal cavity; and a long vulcanized india-rubber tube fitted to the cannula will be the best safeguard. If there be no adhesions, the tumour is now seized with a *strong vulsellum* and easily drawn out, as a bag, through the abdominal aperture; an assistant at the same time following up and closing the wound around the pedicle, so as to prevent any escape of the intestines, by handling the wound.

4. If there be any adhesions, or the tumour be *solid*, the fingers or hand must be passed into the abdominal cavity; the same precaution being taken by the assistant during this manipulation. When the adhesions are slight and situated anteriorly, they are readily separated by passing the hand round the front part of the tumour. When they are *firm, deep-seated, and extensive*, the operation becomes proportionately difficult. Fortunately such adhesions are comparatively seldom found posteriorly, or connecting any of the abdominal viscera, except the uterus. These bands should be torn through very cautiously, not to injure the attached organ; their division with the knife being unsafe, on account of the liability to *hæmorrhage* from the vessels which commonly exist in firm, organized adhesions. If very vascular, they should be secured by fine catgut or silk sutures, and cut off on the cyst side; or, in extreme cases, a small screw-clamp is passed under them, and separation is then effected by the actual cautery. Any risk of *laceration* of the attached organ, as intestine or liver, must, however, be especially avoided; and it will be more proper to cut across and leave the closely adherent portion of cyst-wall, than to incur the danger of visceral rupture.

5. The *pedicle* protruding through the abdominal incision, as guarded by the assistant, the Surgeon proceeds to secure it. This may be effected either by means of a clamp or by *ligature*. The latter is distinguished as the *intra-peritoneal method*. It is now almost universally adopted. It is more simple, avoids drag upon the stump, and, by permitting the closure of the abdominal wound, offers less risk of inflammation and septicæmia. The whipcord ligature seems to answer best, and it should be applied by transfixing the pedicle with a *nævus-needle* armed with the double ligature, and tying each portion securely. Care must be taken not to transfix any large artery or vein, the latter vessels parti-

cularly being large-sized and thin-walled. 6. The pedicle is now to be *divided*, at a *sufficient distance* from the ligature (or beyond the clamp externally), to prevent any risk of its slipping through,—as the pedicle shrinks, after the operation, giving rise to secondary hæmorrhage. The ovarian tumour is thus detached.

Before closing the wound, examination should be made to see if there are any bleeding points on the peritoneal surface of the abdominal walls or viscera. The other ovary should be inspected; and if it present any appearance of disease, it should also be removed, securing the pedicle by ligature; and, lastly, small sponges mounted on sticks or vulsella should be dipped down into the pelvic cavity to swab up blood or any fluid which may have escaped into it.

Drainage.—If irritating fluid has escaped into the peritoneal cavity, or suppuration exist, drainage will be useful.

7. *Closure of the wound* concludes the operation. If the pedicle is ligatured, it is dropped back into the abdomen (if clamped, the clamp of course protrudes externally). Closure may be accomplished by interrupted silk sutures, or by wire sutures; and these are passed through the entire abdominal wall, including the peritoneum. They should be placed an inch from the edge of the incision, on either side, so as to have a firm grasp; and not more than three-quarters of an inch apart. The antiseptic dressing is then applied, supported by broad strips of plaster, and over all a four-tailed flannel binder. A warmed bed should be at hand for the reception of the patient, and any slight stimulant administered which occasion may require.

AFTER-TREATMENT is very important, and it comprises chiefly the following general directions. They have reference specially to the sources of danger after ovariectomy: *shock, peritonitis, exhaustion, secondary hæmorrhage*. To avoid any tendency to vomiting after the operation, nothing should be taken by the mouth during the first twelve hours, but a little ice, and no opium or other medicine. Milk or beef-tea should form the nourishment for several days; with wine or brandy as stimulants, and opium, according to the constitutional state of the patient. The nourishment may be administered by enemata, if the stomach continue irritable. It is not necessary to restrain the action of the bowels. The urine should be drawn off by a catheter two or three times a day. *Peritonitis* must be treated on ordinary principles, as in connection with strangulated hernia. The management of the *wound* is simple. The sutures should be left to the sixth or seventh day; and when they are removed, great care should be taken to support the abdomen and wound, by long broad strips of plaster, and firm application of the flannel bandage.

CHAPTER L.

DISEASES, INJURIES, AND MALFORMATIONS OF THE RECTUM AND ANUS.

Diseases of the Rectum and Anus pertain to the terminal portion of the large intestine, in its limited course of six or eight inches from the left sacro-iliac articulation to the anal orifice in the perineum.

Inflammation and Rectal Abscess.—In the loose cellular texture around the rectum, and particularly in that of the ischio-rectal fossa on either side of the anus, inflammation is very apt to occur, and speedily pass into suppuration.

The SYMPTOMS of rectal abscess are, not unfrequently, indistinct. Pain is felt in the fundament, more especially on passing a motion, and if the feces be hard and irritating. The pain has the usual throbbing character when matter forms; though sometimes this takes place without scarcely any sensation, but that of a dull aching weight as matter accumulates, with a sense of fulness and bearing down by the side of the anus. Hence, two varieties of abscess may be recognized,—the *acute* and the *chronic*. In both, there will be some tenderness on pressure, on one side of the anus; swelling also sooner or later becomes apparent, which is hard and brawny, though perhaps softer at one point. On passing the finger up the bowel, this painful swelling may be felt before it reaches the perineal surface. In connection with these local signs, other symptoms may be present; a constant feeling of expulsive action and desire to relieve the bowel, yet, with straining efforts, only a little mucus passes; or there may be obstruction to the evacuation of feces, and constipation; while a troublesome irritability of the urinary bladder and frequent micturition is experienced, or a difficulty in passing water and even retention of urine. Rectal abscess coming to the surface, points slowly in the perineum by the side of the anus; but, not unfrequently, it opens into the bowel, and perhaps also externally in the perineum. A large-sized rectal opening, allowing the free admixture of feculent matter, with perhaps an external vent to the purulent collection, will be conducive to the severe constitutional disturbance which sometimes happens. *Fistula* is said to result when any opening of a rectal abscess becomes established in the neighbourhood of the anus. The matter discharged from an abscess adjoining the rectum has often a darkish-green colour, and always a fecal odour; more perceptible if there be a communication with the bowel, although it is distinctly fecal in any case, owing probably to transudation.

Causes.—Various local causes give rise to this abscess; any source of irritation, as habitual rectal constipation, worms, or a foreign body in the bowel, as a fish-bone; occasionally, caries of an adjacent bone, as of the coccyx or sacrum, or of the tuberosity of the ischium in one of my own cases; or disease of the bowel itself may be the cause in operation; but, more external injury, as a kick or contusion, may have induced inflammation; or exposure to cold, as by sitting on a cold stone, has brought about congestion, followed by suppuration. Chronic rectal abscess not unfrequently results from obstruction to the venous circulation, and is

symptomatic of some organic disease of the lungs, liver, or heart. Often, as chronic abscess co-existing with a phthisical tendency or actual phthisis, the local disease is of *constitutional* origin. Whenever dependent on venous obstruction, congestion of the hæmorrhoidal veins, or piles, is commonly associated.

TREATMENT.—In an early stage, before suppuration has occurred, resolution can sometimes be effected. Laxative aperients rather than purgatives, and careful regulation of the diet, with warm fomentations, may succeed in dispersing the inflammation. If not thus serviceable, these measures will prepare the way for the better management of suppuration. An *early opening* should be made to prevent the matter burrowing around the gut. As soon, therefore, as the formation of matter can be detected or suspected, although fluctuation be very indistinct, and certainly before any pointing has appeared, the forefinger, well greased, may be passed into the bowel, and the thumb placed below the swelling externally, thus taking the abscess between the finger and thumb, so as to render it tense and defined; a sharp-pointed bistoury should be entered carefully by the side of the bowel, and if a drop of pus rises up by the side of the blade, the opening must be sufficiently enlarged downwards to let out the matter already accumulated and allow a free discharge subsequently. A strip of oiled lint is then inserted. The abscess having been laid open, it usually heals from the bottom, without communicating with the bowel or leaving an external fistula.

Fistula in Ano.—Any pus-secreting tract which passes up by the side of the anus is designated, from its proximity, a fistula in ano. It results from the contraction and partial closure of an ischio-rectal abscess, leaving only this narrow channel. Commonly, it opens both internally, into the bowel, and externally in the vicinity of the anus; sometimes, there is but one orifice,—an external, or an internal. Corresponding conditions of fistula may, therefore, be recognized.

COMPLETE fistula has two openings; one into the bowel, another on the surface of the skin (Fig. 123). **INCOMPLETE** or **blind** fistula has but one opening; an external opening on the skin, but no communication with the bowel,—constituting *blind external* fistula; or there may be an internal opening into the bowel, but no opening on the skin,—forming *blind internal* fistula.

The *integumental* orifice is situated usually over the fossa by the side of the anus; but it may be removed to some distance outwards and posteriorly at the back of the buttock, and towards the great trochanter. Sometimes, there is more than one fistulous opening, even several, resembling a water-pot spout, and all discharging matter. These orifices are scattered in various directions near the anus; and lead by very tortuous, devious routes to the abscess, and thence to the bowel; branch

FIG. 123.*



* St. Thomas's Hosp. Mus.

sinus; this opening is, however, not the termination which usually runs up further outside the bowel into a c

Some peculiarities are presented when anal fistula is *phlegmonous* tendency. The abscess having been of some collection of purulent matter than circumscribed by ly with a diffuse purplish-red discolouration of the integum abscess bursts, or has been opened, it does not so readil fistula; the external opening is large, irregular, livid and discharges a sanious or curdy, fetid purulent matter also is large, even perhaps the size of a fourpenny piece thus readily transmits feculent matter into the fistula. are lax, and the anus is loose.

The *Diagnosis* of the three conditions of fistula in an (1.) *Complete and blind external fistula* both present an by the side of the anus, or otherwise placed. But on p or director along the course of the fistula to the bowel the other hand is then introduced into the gut to fee the instrument; in the one condition of fistula, an open through which the probe can be made to touch the fi intervening; in the other condition, the point of the more or less plainly through the thickness of the bowel back with the finger,—a membranous septum, however t vesting. (2.) *Blind internal fistula* is less readily detecte some bowery swelling and tenderness on pressure extern a burning pain after defecation, owing to the lodgment in the fistula; but there is no external opening. A f from the interior of the bowel, and the escape of pus on incision of the sinus, will both lead to the diagnosis of a and this will be confirmed by feeling the cribrum in the gu is passed into the anus, or the opening may be seen by speculum. The *hæmorrhoid* form of fistula presents some i

is a direct stimulant to the rectal mucous membrane. Some success has resulted from stimulant treatment by means of injections, as solutions of nitrate of silver or sulphate of copper, or with an armed probe, in cases of blind external, and even perhaps complete fistulæ.

OPERATION is usually the only certain means of cure. Operative interference should not be had recourse to in fistula connected with any *persistent local* condition, as disease of the rectum, or caries of the sacrum or coccyx; and still less, when it is dependent on some *constitutional* condition, advanced phthisis in particular.

The principle of operation is simply this,—that the fistula being kept open by the almost constant action of the adjoining sphincter ani muscle, division of this muscle will set the part at rest, and allow it to heal and close from the bottom. Accordingly, the bowels having been well cleared with castor oil or other mild aperient medicine, and the rectum emptied by an enema on the day of operation, the patient is laid on the side most convenient to the operator; the thighs are drawn up so that the buttocks shall project over the side of the bed or table, and the latter held apart by an assistant. A probe, or director, introduced through the external opening in the skin, will guide to the internal opening, should it exist, or to a spot where the bowel is thin and about to give way. At the same time, the forefinger of the other hand is introduced into the rectum until it rests upon or feels the point of the director, which is then held by the assistant with the other hand.

A curved, narrow-bladed bistoury, blunt-pointed or sharp-pointed according as the fistula is complete or incomplete, is slid through the external orifice of the fistula, along the groove of the director, until it touches the point of the finger in the rectum, when the director may be withdrawn (Fig. 124); the fistulous tract is then laid open freely into the bowel—the knife dividing at one sweep the skin, sphincter, and bowel, and coming out of the anus, with its point still resting on, and protected by, the point of the finger. When

FIG. 124.



the internal orifice is near the surface, just above the sphincter, the director may be bent round and made to project from the anus; and then the fistula can be divided,—without passing the finger up the bowel to meet the point of the knife. It will be observed that the *cul-de-sac*, above the opening of the bowel, is left undivided in the operation as thus described. Its division is unnecessary, to fulfil the principle of the operation, and might implicate branches of the middle hæmorrhoidal artery,

producing serious hemorrhage. This terminal portion of the fistula generally closes, with the open tract, now that the sphincter ani is divided and set at rest. If one or more branch sinuses exist, they also may be laid open, although a dependent tract of this kind will often close after the operation. But a deep burrowing sinus had better be opened up, while a superficial offset may be left alone. An infected fistula may be slow to heal, even when laid open; it will be advisable, therefore, to reverse the knife, and draw the blade through the tract into the sound textures, tailing off this incision beyond the external orifice,—as the “back-cut” practised by Salmon. The surrounding hardness then soon disappears, and the wound granulates readily from the bottom. In women, when fistula in ano opens near the perineum, any free division into the bowel is very apt to result in fecal incontinence. The incision, so far as may be necessary, should be made to divide the sphincter laterally.

(1.) *Complete fistula, and blind external fistula*, are thus operated on. (2.) *Blind internal fistula* presents no external orifice; a bent director must, therefore, be passed up through the anus, and diverted into the rectal opening, thence downwards to the integument. When its point is plainly felt projecting, a puncture should be made with a sharp-pointed bistoury, and the operation completed in the usual manner. Or, if any fluctuation can be detected externally, the knife may be entered at the thinnest spot, a director passed through into the bowel, and the operation finished as usual. For *horseshoe-shaped fistula*, a one-sided operation would prove ineffectual; the fistulous passage must be slit up throughout its course, from one side of the bowel to the other, and the sphincter divided through the opening.

In concluding the operation, a narrow strip of oiled lint should be passed up the bowel, into the cul-de-sac when it exists, and laid within the wound of the open fistulous tract; observing also that it lies between the divided sphincter, as well as in the fistulous tract. If only a twirl of lint be used, and drawn back to the outer orifice, the bowel may close, and thus the fistula be reproduced. Healing and closure by granulation takes place from the bottom. But it will be unnecessary and undesirable to continue this lint-tent longer than the first two or three days,—until the incision is filmed over, so that primary union cannot occur. If its application be unduly *prolonged*, the wound may become a chronic granular cleft, indisposed to contract and cicatrize; or it heals, leaving a gap, and a weakened state of the sphincter muscle with a tendency to the involuntary escape of feces and flatus.

AFTER-TREATMENT.—The bowels having been thoroughly emptied before operation, no action may take place for two or three days; any liability to disturbance must be restrained by opium, and then the gentlest aperient—castor oil—should be administered. Hemorrhage rarely proves troublesome. At the time of operation occasionally, bleeding may be such as evidently to require special means to arrest it; any vessel bleeding *per saltum* may be twisted or tied, but the wound should be plugged with lint to the bottom, and a compress applied, secured by a T-bandage. Then the patient should be watched, lest hemorrhage continuing internally, and the blood passing up the bowel, a large quantity might be lost imperceptibly. Secondary hemorrhage, occurring

in the course of a few hours, must be treated in like manner; the clots removed, ice-cold water injected, and a plug introduced well up the bowel. The wound heals usually in two or three weeks.

LIGATURE of the septal portion of bowel has sometimes proved successful. A horsehair, or flexible wire, or an elastic india-rubber ligature is passed, by means of an eyed probe, through the fistula into the bowel; the two ends are tied, and adapted to a small screw. The ligature is tightened, as it ulcerates its way through the septum; in a week or two it becomes detached, the fissure at the same time granulating from the bottom. One advantage attends this method of dividing the fistula—hæmorrhage is less likely to occur. Ligature may, therefore, be more appropriate than cutting with the knife, in *deep* fistula; where that operation might implicate the middle hæmorrhoidal artery. But in long, narrow, and tortuous fistula, the introduction of a ligature will scarcely be practicable; and in any case, this method of cure is tedious and painful.

Ulcer of the Rectum, and Fissure of the Anus.—These two conditions may exist separately, or co-exist. ULCER of the rectum is situated just *within* the *sphincter ani*, and usually at the posterior part, near the coccyx; occasionally, however, having a lateral, or a perineal position. Extending outwards, perhaps, to the anal aperture, it is commonly associated with a small *external hæmorrhoid* or pile, beneath the base of which the terminal limit of the ulcer lies concealed. Thus defined, the ulcer is situated partly within the rectum, just above the ring of the sphincter muscle; and partly within the circumference of the anal aperture, approaching the condition of fissured anus. The ulcer is quite *superficial*, and varies in size from a large pin's head to a large *split pea*; when distended, it has an *ovoid* or circular shape; its surface is smooth, or rough when relaxed, and the colour may be reddish or sloughy ash-grey, with a slightly indurated margin. It lies, almost concealed, *between the longitudinal folds* of the *rectal* mucous membrane, the edges of the sore appearing only as a small fissure in the direction of the bowel; but on distending this passage with the speculum, the ulcer is brought into view, and its characters may be recognized.

FISSURE of the anus is situated at the *anal aperture*—the junction of the mucous membrane and integument, and not involving the rectum; but, like rectal ulcer, usually having a dorsal position. It consists of a *crack* or streak of excoriation, running lengthways *between the loose folds* of mucous membrane and *integument* which surround the *anus*.

The SYMPTOMS of these ulcerative affections are easily recognized. Both states are *acutely painful*, out of all proportion to the limited extent of structural lesion, and the constantly recurring suffering gives a remarkably haggard and pallid expression of countenance; both states also, especially rectal ulcer, are attended with more or less *spasmodic contraction* of the sphincter,—like that of an india-rubber band, having a sharp upper margin, and, with some irritability of the urinary bladder, a tendency to spasmodic stricture and seminal emissions.

Proceeding to DIAGNOSIS:—with ulcer of the rectum, sometimes distinguished as “painful” and “irritable” ulcer, there is most acute burning pain in passing a motion; the suffering increases *after* the act, and continues for a considerable period, varying from a quarter of an

hour to several hours, and then subsiding into ease until the bowels are again moved. With fissure of the anus, there is smarting or even equal pain, as a motion passes; but it subsides within a few minutes, when the temporary irritation has ceased, and the more readily if the part be sponged and cleansed properly after the act. Some amount of bloody purulent discharge may be observed in both ulcerative affections; and in that of the rectum, considerable hæmorrhage may occur; but here there is no external appearance of ulceration, unless the part be protruded and carefully examined; yet the ulcer can be felt and seen. On introducing the finger just within the anus, and generally towards the coccyx, a small depressed surface can be detected, with a somewhat hard and raised border—unlike the inner orifice of a fistula; touching this spot causes sharp, burning pain, and provokes a more powerful spasmodic contraction of the sphincter around the end of the finger. By examining the rectum with the speculum ani, the ulcer may be brought into view through the open side of the tube. To facilitate either method of examination, in this and all other painful affections of the interior of the rectum, the influence of chloroform is an invaluable boon both to the patient and the Surgeon. In fissure of the anus, the ulcer-crack can be discovered by a little careful search *externally*.

The CAUSES of these ulcerative affections would seem to be: *rectal constipation*, in the production of ulcer within the bowel, and this may be aided by violent straining defecation; while the external fissure is probably induced by want of *cleanliness*, as by gonorrhœal matter coming in contact with the thin sensitive skin around the anus, or by that syphilitic discharge which begets mucous tubercles. Females, therefore, are most liable to such anal ulceration; owing to the proximity of the vaginal discharge, and the easily cracking nature of their perineal and anal integument. But not unfrequently either form of ulceration is connected with uterine displacements. Middle age is most subject to these affections. A sedentary occupation predisposes to fissure.

TREATMENT.—(1.) In recent ulceration and of slight extent, a cure may sometimes be effected by *stimulant* applications, with *anodyne* suppositories to allay pain; the bowels being well regulated by castor oil, or other gentle aperient, and scrupulous attention to cleanliness observed after any action of the bowels, or as to any other source of irritation. Accordingly, the ulcerated spot may be touched occasionally with stick nitrate of silver or a piece of sulphate of copper; and in fissured anus, the caustic must be run along within the crack so as to fairly touch the bottom of the angle.

(2.) In *old-standing* and more *extensive* ulceration, operative interference is the only cure.

The *operation* is easily done, when the anus is thoroughly opened by an assistant. The forefinger is introduced into the rectum, opposite the sore, and a probe-pointed bistoury slipped up sideways, and planted just above the ulcer or fissure; the blade is then drawn downwards and outwards steadily along the centre of the sore or in the fissure, dividing the mucous membrane—the depth being about the eighth of an inch. This incision may advantageously extend into the sound texture, a little above and below the upper and lower end of the ulcer or fissure. A thin strip of oiled lint should be laid in the wound and retained for a day or two. An

overhanging external pile may be snipped off with scissors; and a mucous or fibrous polypus, within the bowel, should be removed by ligature. Double fissure must be operated on in the same way as a single crack.

The only preparation for this simple proceeding is thorough evacuation of the bowels beforehand; and the only *after-treatment* requisite is an opiate, to lessen pain and prevent any action of the bowels, followed by a dose of castor oil in two or three days. The relief afforded by section of the mucous membrane is almost instantaneous, and the patient feeding well, daily regains health and spirits. In the course of two or three weeks, the wound will probably have healed.

Dilatation of the sphincter was originally proposed by Recamier, and is much advocated by Dr. Dolbeau. Owing to long-continued spasmodic contraction, and consequent hypertrophy of the sphincter, the anal aperture often feels like a tight band or cord, grasping the finger when introduced. Moderate and gradual dilatation with the opposed fingers will succeed in overcoming this constriction, and then the muscle or border of the anus should be compressed between the thumb and finger until it feels softened, as well as relaxed. The fissure being placed at rest by this manipulation may heal without incision, or under stimulation.

ULCERATION OF THE RECTUM is met with also above the internal sphincter, extending up the bowel to three or four inches, or even involving the sigmoid flexure of the colon. The mucous membrane is removed in parts, exposing the muscular coat in the form of *deep patches* of ulceration; perhaps the intermediate portions of mucous membrane become detached, leaving only bridges or mere bridges between the ulcers; and, these remnants at length disappearing, the interior of the bowel is laid bare to a variable extent. In point of depth, the ulceration may be accompanied with thickening of the submucous tissue, or hypertrophy of the muscular coat, resulting in contraction or *stricture* of the bowel; but, not unfrequently, *perforation* takes place with fatal extravasation of feculent matter; or if this result be prevented by adhesive peritonitis of the intestine or omentum, *abscesses* form around the bowel, and open externally by fistulous passages.

The SYMPTOMS of this rectal ulceration are insidious, but not peculiar. There is some tendency to griping diarrhoea, with a discharge,—mucopurulent, slimy, or gelatinous, tinged with blood, or of a brown colour; unattended, however, with much pain, unless the ulceration has extended downwards within the sphincter ani. The disease simulates dysenteric diarrhoea. Examination per rectum will show the nature of the case. Ultimately, as the passage becomes somewhat contracted, constipation supervenes, relieved by diarrhoea, and the other symptoms of rectal stricture are presented; or simply fecal incontinence ensues.

Any assignable CAUSE of the initial lesion is often obscure. The ulceration may proceed from the irritation of impacted feces, or abrasion from an enema-syringe; but more often it has a *syphilitic* or *scrofulous* origin, and there are other concurrent symptoms of either disease.

TREATMENT must of course have reference to the particular cause of ulceration, whether that be *local* or *constitutional*. In the event of contraction sufficient to obstruct the passage of feces, dilatation, with perhaps guarded incisions, may prove effectual; or colotomy may be expedient; and should the ulceration have extended within the grasp of the

sphincter, that muscle must be divided to relieve pain and promote cicatrization.

Hæmorrhoids—External—Internal, with Prolapsus of the Rectum.—Hæmorrhoids, commonly called Piles, are essentially an enlargement of the hæmorrhoidal veins, around the anus, or within the sphincter at the termination of the rectum.

Hæmorrhoidal affections are named distinctively according to their situation: *subcutaneous* and **EXTERNAL** to or below the sphincter,—around the margin of the anus; or *submucous* and **INTERNAL**, or above the sphincter,—at the termination of the rectum. In the latter situation, this enlargement of the veins, forming internal hæmorrhoids, is accompanied with a tendency to descent and protrusion of the overlying mucous membrane, through the sphincter or anal aperture, constituting a form of Prolapsus of the Rectum. Practically considered, it will, therefore, be convenient to describe Internal Hæmorrhoids and this Prolapsus as one disease. The anal cutaneous integument has a similar tendency to relaxation. But the distinctive terms, external and internal Hæmorrhoids, are not always obvious; the one condition merges into the other, owing to the continuity of the hæmorrhoidal veins. Hence an intermediate variety has sometimes been recognized,—named **INTERO-EXTERNAL Hæmorrhoids**, situated partly within and partly without the Anus.

Hæmorrhoids—as a dilated and varicose condition of the hæmorrhoidal veins, are connected, partly with the general venous system, principally with the portal venous system. This twofold venous relationship nearly corresponds to the situation of Piles, as external or internal to the sphincter ani; and hence the significance of the usual designation of these affections of the hæmorrhoidal veins, as thus distinguished.

EXTERNAL Hæmorrhoids, at first consisting of one or more dilatations of the external hæmorrhoidal veins at the verge of the anus, are easily recognized.

The **SYMPTOMS** relate to the various stages of progressive development and decline of this hæmorrhoidal affection. It appears at or near the verge of the anus, in the form of one or more *small, rounded, or oblong tumours*, which are *soft and compressible*, and of a *livid blue tinge*. When largely produced around the anus, a bunch of these venous swellings somewhat resembles Hamburg grapes, to which they have been compared in appearance. They are accompanied with a painfully depressing sense of bearing-down fulness at the fundament, especially in the standing posture and after any straining effort of defæcation or micturition; heat, itching, or smarting add to the patient's discomfort. A crack occurring, sometimes, at the base of an external pile, the irritation and pain thus occasioned aggravate the hæmorrhoidal suffering. When *coagulation* takes place in the sacculated venous dilatation, or in a cyst resulting from rupture of the vein and extravasation of the blood into the surrounding cellular texture, or when plastic infiltration of the interstitial cellular texture has supervened, the tumour becomes *solid, harder*, and proportionately incompressible; its colour also is less clearly blue, as the vein, cellular texture, and the skin become thickened. The fold of skin, which contained the dilated vein, remains, as the vein subsides; and the tumour then presented is a *loose pendulous* bit of anal integument. This result is simulated from time to time during the active state of an external pile; the tumour

being loose and flaccid when empty in the interval of an attack, and again tense whenever congestion supervenes. In this state—that of *congestion*—external piles are occasionally liable to *inflammation*, accompanied with increased enlargement of the hæmorrhoid, forming an oval tumour, tense, red, and acutely tender. Suppuration may ensue, converting the pile into an *abscess*; this bursting, the clot of blood escapes with the pus, and when the abscess closes, the venous dilatation usually becomes obliterated; thus reducing the pile to a small flap of integument. A *fistulous opening* sometimes remains, which might be mistaken for the orifice of a blind external fistula. Examination with a probe, as to its depth, will at once show the difference.

INTERNAL Hæmorrhoids consist of *larger veins* higher up, dilated irregularly or into *pouches*, filled with dark coagula, often compact and hard, and forming prominent projections of the rectal mucous membrane; thus deepening the recesses there existing, between the folds. Two or three of the larger prominences of the longitudinal folds, meeting below, *coalesce*; presenting a transverse fold just within the sphincter (Fig. 125). The *arteries*, which are abundantly supplied to the lower part of the rectum, and have a longitudinal course towards the orifice where they freely communicate, also enlarge considerably. As the venous or arterial element preponderates, so may be recognized two principal varieties of internal hæmorrhoids—the *venous* and *arterial*; and of the latter, a sub-variety—the *capillary*; these varieties sometimes appearing singly, or associated in the same individual.



FIG. 125.*

The SYMPTOMS *contrast* in two important particulars with those of external piles. At first, internal piles present *no external appearance* at the anus, but they not unfrequently *bleed*. Hence, the distinction commonly made of Piles into *open* and *blind*, as they bleed or not. The first symptom of internal piles is, generally, an attack of hæmorrhage, venous or arterial, and more or less profuse; merely tinging a motion, or escaping as a few drops of blood afterwards, or to the amount of several ounces. Accumulating within the bowels sometimes, the actual loss of blood from the system may be greater than appears at first sight. This discharge of blood is attended with, or preceded by, a *bearing-down* weight in the fundament, and a sensation as if a lump were lodged within the end of the bowel; there may be also a more or less frequent desire to micturate, or spasmodic retention of urine. *Straining efforts* are made to evacuate the contents of the bowel, the passage of feces being both difficult and painful; at length, hæmorrhoidal tumours, with mucous membrane, are *protruded*, or prolapsed to some extent at the anus, in the act of defæcation, accompanied with mucous discharge. Commonly, there are *three distinct prominent tumours*, differing in size from that of a walnut to a hen's egg; one at each side of the anus, and a third in front,—this, the perineal, being usually the

* Roy. Col. Surg. Mus.

largest. In old-standing cases, there may be four or five such projections. Their boundaries are generally well marked; or the piles merge into each other, forming a nearly *circular protrusion*. A *single pile*, of large size, is sometimes the only protrusion, situated towards the front of the anus adjoining the perinæum. Consisting of bright-red mucous membrane connected with a loose fold of integument, it often forms in young persons, especially women.

(1.) The *venous* and *arterial* varieties of internal hæmorrhoids may be distinguished chiefly by their colour, respectively; *bluish*, or *reddish*, and the latter *pulsating*, perhaps freely, to the touch, especially at the base of the swelling. In both cases, the protrusions or tumours are more or less *firm* or even hard, from containing some coagulated blood, and thickening of the mucous membrane. Either variety of hæmorrhoid is disposed to bleed readily under pressure with the finger; and the blood is either of a dark, or florid red, colour; in the one case issuing as an oozing hæmorrhage, in the other escaping with a jetting flow.

(2.) *Capillary* internal hæmorrhoids are characterized by the *raspberry-like surface*, *florid* colour, and *spongy consistence* of the tumours, which readily bleed when touched; they are of *small size*, and form *higher* up in the rectum,—protruding little or never. The symptoms of these piles are less definite; perhaps only an aching pain in the loins, with increasing weakness and anæmia from frequent loss of blood. In *men*, a painful dragging-down sensation in the testicles, and gradual loss of sexual power, with mental depression, add to the patient's misery; while, in *women*, the general health is impaired by amenorrhœa, obstinate constipation, and other symptoms of chlorosis.

EXTRUDED Piles exhibit a variable appearance also, depending on their condition as being *congested*, or *constricted* by the sphincter. In an inactive state, and in a relaxed state of the sphincter, they form softish tumours of a red granular appearance, protruding just at the orifice of the anus; when fully protruded, tightly constricted, and congested, they are large, tense swellings of a deep-red or purple colour, and having a smooth surface, which readily bleed. *Ulceration* takes place occasionally, attacking the tumour in many points at once, but advancing seldom to any great extent. *Mortification* and *sloughing* of the hæmorrhoids may result from complete strangulation by the sphincter; a process of natural cure which sometimes occurs, and, although attended with much suffering, it is free from any danger of hæmorrhage.

When the hæmorrhoids are of large size, and fully protruded, the *integument* at the margin of the anus becomes *everted*, and forms a *broad band* girding the base of the tumours externally. The skin, thus everted, swollen, irregular, and of a livid colour, is liable to be mistaken for external piles; but its excision in an operation would probably be followed by serious contraction of the anus.

External and Internal piles often do *co-exist*; but then the sphincter, covered by integument, usually forms a *narrow band* separating the two. When, as sometimes follows, the two forms *merge* into each other, their difference may be recognized by the character of the integument—*skin* or *mucous membrane*. Another method of distinction is to gently return the protruded part, requesting the patient, at the same time, to draw up

and thus retract the bowel; whatever portion then remains outside is external pile, the reduced portion being internal pile. The mucous membrane, from frequent exposure, assumes a cutaneous appearance.

Inflammation of internal piles is apt to be induced by the irritation of a costive motion, a brisk cathartic, a slight excess of wine, or irregularity of diet; producing what is called an "attack of piles." Their inflammatory *swelling* is attended with a sensation of *heat*, weight, and fullness, just within the rectum; difficulty and pain in passing a motion, and distressing irritability of the bladder. *Pain* of a dull aching character may be felt in the loins and down the thighs, leading to the supposition in females that the womb is affected. Febrile constitutional disturbance is often severe. Protrusion takes place at the anus, in the act of seeking relief by stool, or in straining to empty the bladder; the extruded hæmorrhoids become constricted by the sphincter, and the congestion which results from strangulation of the acutely sensitive inflamed piles, entails yet further suffering. Suppuration and the formation of *abscess* in internal piles sometimes result from inflammation; the discharge of purulent matter gives relief, a small orifice may be felt with the finger in the rectum, through which a probe is readily passed into the abscess of the pile, and the probe may be easily run through the wall of the pile and along the submucous cellular texture up the bowel, thus perhaps leading the Surgeon to suppose that there is a blind internal fistula.

DIAGNOSIS.—Internal Piles must be distinguished from prolapsus of the rectum, occurring alone, from polypi of the bowel, and from condylomata about the anus. *Prolapsus* in the form of a rugous flap of mucous membrane, on either side of the anus, is most liable to be mistaken for protruded piles. But the semilunar form of these flaps, the extent of their base, the gliding feeling of the folded membrane between the thumb and finger, and the absence of erection and hæmorrhage, are all diagnostic signs. In *polypus*, its pedunculated character, large size, incapability of erection or collapse, pale-red colour, and slight disposition to bleed, will be sufficiently distinctive of every species of this growth. Moreover, mucous polypus has a very soft spongy feel; and fibrous polypus, a solid and firm consistence. *Condylomata* are readily distinguished from piles, by their flat-shaped, soft, and mucous character, or their warty appearance; and their occurrence in other parts, as the scrotum or vulva.

CAUSES.—All the causes of hæmorrhoidal affections operate by producing congestion of the hæmorrhoidal veins, chiefly by *obstructing* or retarding the portal circulation, and thence the return of blood from the rectum; or by inducing a *determination* of blood to that part. (1.) *Predisposing* causes comprise various circumstances, more or less affecting the *general* or the *portal circulation*; age—adult life, or middle age; sex—males rather than females are liable in adult life; but conversely, after cessation of the catamenial discharge, in later life, and women who have borne many children are more subject than men; climate—warm and moist, or changeable; period of the year—spring and autumn; hereditary predisposition; plethora, and the suppression of other hæmorrhages; passions, whether violent or depressing; tight lacing, or the application of bandages to the lower limbs; sedentary occupations or habits; sitting on stuffed or on pierced seats; and, as specially affecting the *portal circula-*

tion:—prolonged walking or other exertion, indulgence in alcoholic drinks, *habitual constipation*, disease of the *liver* or *heart*, displacements of the uterus, pregnancy, or the development of other tumours in the abdomen or pelvis, and the straining efforts at micturition, with disease of the prostate, stone in the bladder, or stricture of the urethra; and the habitual excess of venery. (2.) *Exciting* causes are principally of an *irritant* character, as affecting the intestinal canal, and which induce a *determination* of blood to the rectum; such are stimulating purgatives or enemata, excess of wine, spiced or other stimulating food, a costive motion, ascarides, diarrhoea; unhealthy discharges from intestinal disease; or external irritation, as hard riding on horseback, or from the neglect of anal cleanliness.

TREATMENT.—Remedial, as well as preventive, measures must have reference to the various causes of hæmorrhoids; and the removal of such causes will be suggested in many cases by their nature, whether predisposing or exciting in their action.

CONSTITUTIONAL treatment is both medicinal and hygienic. To relieve *portal congestion*, the bowels must be carefully regulated by mild aperients which shall influence the whole intestinal canal and promote the secretion of bile, and by attention to diet, with daily walking exercise,—excepting during an attack of piles, when the patient will be sure to seek the recumbent posture. The state of the *general circulation* should, at the same time, be regarded; in plethoric persons, a depletory course of aperients and reduced diet being indicated; in weak, anæmic persons, a tonic and unirritating dietetic plan of treatment. Thus may be advantageously combined aperients and tonics. A daily dinner pill is a convenient mode of administration; consisting of the watery extract of aloes, compound rhubarb pill, and blue pill, with *nux vomica*. The watery extract dissolves more readily, and acts before reaching the rectum. To correct *habitual constipation*, other forms to be recommended are, in particular, a lenitive electuary, consisting of bitartrate of potash and precipitated sulphur, in equal parts, with perhaps a little confection of senna, and sufficient honey or treacle to form an electuary. A teaspoonful may be taken every night at bed-time. In *hepatic cases*, Friedrichshall and Carlsbad waters act most beneficially as flushing aperients, for occasional use. Taraxacum in large doses—ten or fifteen grains—and Plummer's pill are both efficacious agents for relieving the portal circulation through the secretion of bile; and the mineral acids, especially the nitro-muriatic, seems to have some influence in that way; while as tonics they support the general circulation. The confection of black pepper, Ward's paste, has long been in great repute as a remedy for piles; a drachm dose being taken three times a day, and continued for two or three months. It is supposed to act directly on the piles as a stimulant application, and might therefore be more advantageously introduced at once into the rectum.

LOCAL applications are important adjuncts to the constitutional treatment, and as a means of allaying pain. (1.) EXTERNAL piles may be sponged with cold water, or with some *sedative* and *astringent* wash, as lime water, weak lead lotion, or a weak solution of alum, sulphate of zinc, sulphate of iron, or of the muriated tincture. The unguentum gallæ is also beneficial. (2.) INTERNAL piles are amenable to similar applications used

internally as injections or lavements. *Cold water* alone, thrown into the rectum every morning, often proves very efficacious in constricting the dilated vessels and softening the motion which follows its use. Medicated astringent injections, as of iron or alum with decoction of oak bark, had better be employed at bed-time, than during the night any such application may have time to act on the piles. But they should be weak solutions, as a grain of sulphate of iron to an ounce of water; and used in small quantity, only two or three ounces at a time. *Citrine ointment* is very beneficial when the hæmorrhoids are in an unhealthy state, accompanied with a slimy discharge; a little of the ointment being inserted within the sphincter every night, by means of the finger, which the patient can himself accomplish. An ointment of nitrate of silver is also very useful, although liable to stain the linen.

INFLAMMATION.—When piles become *inflamed*, the recumbent position and cold or warm applications will be appropriate. Pounded ice is highly recommended by Mr. Curling, who finds that it generally gives complete relief in a few hours. Warm fomentations or poulticing may be preferable, and if several piles be affected, a few leeches should be applied round the tumours. (1.) An *external* pile may be opened with a lancet, and the coagulum squeezed out; an abscess should be punctured and poulticed. (2.) *Internal* piles having *protruded*, they must be returned by gentle uniform pressure, to empty them of blood, and then to push them back within the sphincter. The piles being slippery from mucous discharge, they are compressed with a piece of soft linen. If they descend again immediately, or when tightly strangulated, they may be punctured in several places with a needle, and cold or iced water applied, with an elevated position of the pelvis; and then by a little manipulation they will probably slip up. Prolonged strangulation and a tendency to sloughing forbid any attempt at reduction; warm fomentations should be used. Sometimes the suffering is much aggravated by spasmodic contraction of the sphincters; but this state of the anus may be overcome by dilatation with the fingers, which gives immediate relief; at the same time reducing the congestion and thus retarding the subsequent enlargement of the hæmorrhoids.

OPERATIONS.—When piles are beyond the control of medical treatment, general and topical, or hæmorrhage from them is detrimental to health, operative interference becomes necessary. No such interference should be resorted to if the piles be in a state of active inflammation, excepting, perhaps, when they are quite external. Piles may be removed by excision, ligature, or cauterization. The first method is applicable almost exclusively to External hæmorrhoids; the latter two are appropriate for the removal of Internal hæmorrhoids.

(1.) *Excision* is a simple operation, easily performed, and very effectual. The patient lying on his side, with the knees well drawn up and the buttocks held apart, the tumours are seized with a vulsellum or hooked forceps, and successively snipped off with scissors curved on the flat, and applied flatwise at the base of the tumour. Any loose, redundant portion of skin may be included in the excision, but all such integument should not be removed, lest the contraction of cicatrization might leave the patient with a strictured anus. Hæmorrhage is easily controlled by cold and the pressure of a pad, secured by a T-bandage. A

Internal piles have also been submitted to excision, the wound being secured by tannin, and the risk of recurrence prevented by plugging with a cryptic solution of tannin some of each forming a good astringent.

(2) *Ligation*.—Internal piles are most successfully ligatured. It is the safest procedure, owing to the liability and the most permanently curative,—in preventing the hemorrhoids with the accompanying prolapsus of the mucosa. The operation is, however, not so free from risk, as Mr. Syme has represented. Erysipelasous inflammation may creep up the bowel; pyemia and tetanus are also occasional. But Mr. Allingham's statistics show a mortality of less than 1 per cent. The conditions of internal hemorrhoids for this method of removal are—where the tumours consist of prominent, globular or pedunculated, venous dilatations, blue appearance; or where the tumours have a bright red, velvety, lobed, but the prolapsed mucous membrane abundant. A marked tendency to uncontrollable hæmorrhage, will always render the operation requisite. In uncommon association of some uterine displacement as the cause of internal piles, should be ascertained; for the operation would be useless that condition were rectified.

The bowels having been thoroughly emptied by castor oil or other mild aperient, an enema of warm water should be given before the operation, in order that with its evacuation the pile will be in view. This effect may be aided by desiring the patient to strain over a pan of warm water, and bear down. Then, lying on the left side, most convenient to the operator, with the knees drawn up, the buttocks separated by an assistant, one of the tripartite specula is seized with a vulsellum (Fig. 126), doubled, or with the loop-eyed forceps, and drawn down towards the anus as far as to fully expose the junction of the anal mucous membrane. At this point, a deep notch or incision is made, and the pile is seized with a vulsellum, and drawn out.

ature of fine whipcord is passed down well into the notch, and round the root of the pile, and knotted so as to securely strangle. Sometimes, the base of the protruded portion is too broad to be thus regulated; then it must be *transfixed*, by passing a deeply curved

as-needle, armed with a double ligature, through the base, and each half tied separately. (See Fig. 126.) The portions of the protrusion are ligatured in the same way. Any *external* or *redundant* portion of anal integument may be removed. The ends of the ligatures are cut off close to the piles, or one end of each should be left long if hæmorrhage be likely to recur. In either case, the protrusion had better be turned into the rectum, otherwise the pain occasioned subsequently by the constriction of the sphincter will be more than that of the operation; the presence of the protrusion, as a source of irritation, especially as itching ensues, is apt to induce inflammation and even gangrene of the surrounding anal integument. If hæmorrhage occur, the ligature-ends, coming out of the anus, will enable the Surgeon to draw the parts out and secure any bleeding vessel. An *old* protrusion, however, may be reducible, or will not remain up; and then the mass beyond the ligatures should be cut off.



The *after-treatment* is very simple; an opiate suppository is introduced into the bowel, or a full dose of opium is given the first night, to prevent pain and any action of the bowels, and the liability to irritation at the neck of the bladder with spasmodic retention of urine. A dose of castor oil may be given on the third or fourth day; and one or two of the ligatures sometimes come away with the evacuation. The whole are removed in about a week; but still the patient should keep his bed for several days longer, to insure the closure and contraction of the mucous surface, before the upright posture is resumed. *Secondary* hæmorrhage, usually venous, sometimes happens when the ligatures separate, the blood accumulating in the bowel, and the only indication being that the patient experiences a trickling sensation, and becomes faint. On passing the finger into the rectum, clots are felt, and expelled. Careful *plugging* with a compressed wet sponge, powdered with persulphate of iron or alum, effectually stops the loss of blood; the sponge having been securely secured with a twine ligature in order to withdraw it. This compress is pushed up the bowel, guided by the forefinger, to above the source of hæmorrhage—say, four or five inches—and then pulled down, so as to hold it in position. The plug should not be removed under a week. To provide for the escape of flatus, an elastic catheter may be passed up

through the sponge into the bowel. And thus also by an injecting syringe, any decomposing matter can be washed out.

(3.) *Cauterization*.—This method of treatment is intended as a substitute for the ligature of internal piles, in certain forms of these hæmorrhoids. When the tumour is *flat* and *sessile*, of a *bright-red colour*, and easily *bleeds*, its substance consisting more of small arteries than of dilated veins, or in the capillary hæmorrhoid, a ligature is less readily applied to the base of such a shaped tumour, and cauterization with strong nitric acid is equally effectual in destroying the pile. So also if its *mucous covering* be granular or *ulcerated*; or without any decided hæmorrhoidal tumour, if the rectal mucous membrane be *congested* and *relaxed*, with a tendency to *bleed*; nitric acid is very beneficial, especially in the latter condition.

Cauterization, by means of strong nitric acid, is very easily applied. Protrusion of the pile may be caused as for the operation of ligature; or the application made through an anal speculum—a tube open on one side, by which the diseased surface can be reached. A glass rod or brush dipped in the acid is rubbed freely over the surface, until it assumes an ash-grey colour, when the part should be dabbed with a piece of lint saturated with prepared chalk and water; the protrusion is then returned into the rectum, or the tube withdrawn. The only precaution should be to avoid touching the surrounding anal integument, for which purpose it may be well smeared with oil or grease before applying the acid.

(4.) The *clamp-procedure* is a combination in principle of the treatment by ligature and cauterization. The tumour is seized and drawn down with a vulsellum, and its base compressed with the clamp for a few minutes; its free surface is then *excised*, not too close, by a pair of scissors, curved on the flat; and the surface thus exposed is touched with the strongest nitric acid, or with the *actual cautery*, at a dull red heat,—observing not to touch the clamp, lest the heat be communicated and the operation rendered more painful, even although an ivory-plated instrument be used. The clamp is removed, and the part, being well oiled, is returned within the anus, completing the operation. This method of treatment is not generally practised.

Prolapsus of the Rectum.—In connection with internal hæmorrhoids, prolapsus of the rectum is an almost necessary accompaniment. The latter may, however, occur alone, and this protrusion through the anal orifice is sometimes called *prolapsus ani*; an incorrect designation, seeing that the anus, as merely the terminal aperture of the rectum, cannot itself be protruded.

Prolapsus recti is met with in two forms. Usually, the *mucous coat* alone descends, owing to its loose connection with the muscular coat; and the prolapsus then consists of an everted duplicature of mucous membrane. Occasionally, the *muscular coat* also descends with its membrane.

SIGNS.—The signs or appearances of prolapsus recti are very obvious; the protruded part has the ordinary vascular-red colour of mucous membrane, and is wet with mucus; the surface may be thrown into transverse rings or folds around the protrusion. Its shape varies, and apparently according to the extent of the part. Commencing usually in the form of one or two lateral folds of mucous membrane on either side of the anus, the protrusion soon becomes an unbroken ring, encircling the anus; as it

it acquires a cylindrical shape, tapering somewhat towards its end and there presents an orifice at the reflexion of the membrane, which leads into the bowel. This is now the anal orifice of the

The extent of protrusion varies considerably; in children, perhaps, to six or eight inches; in adults being more limited, being more of a globular than a cylindrical form. In old persons, prolapsus frequently attains a large size, owing to the laxity of the rectum. At either extreme of life,—infancy or old age,—complete prolapsus of the rectum, involving the whole thickness of the gut, is more common.

Two forms of prolapsus may be readily distinguished; in the first, the *mucous membrane* alone, the protruded portion is *continuous* with the investing the sphincter; whereas, with *invagination* of the thickness of the gut, there will be a *distinct* and *deep sulcus* between the protrusion and the margin of the sphincter.

CAUSES of prolapsus are predisposing, or exciting, in their origin. (1.) *Predisposing* conditions may be fairly expressed by the general debility with an *atonic* state of the *intestinal canal*. Thus, prolapsus of the rectum is met with most frequently in weakly children, and who are the subjects of atonic, flatulent, dyspeptic symptoms—in women, repeated pregnancy and parturition is often conducive to the same result. (2.) The *exciting* causes of this affection vary with the mode of life; in *childhood*, ascarides or some other source of *intestinal irritation*, giving rise to diarrhoea, frequently results in prolapsus—especially when the child is habitually placed upon a chamber pot and there allowed to strain away; in *adults*, *constipation*, and the accumulation of feces in the rectum, is the more common mode of being induced by the straining efforts in defecation. The bowel comes forth with each evacuation, and progressively enlarges. Other causes in a similar manner; stone in the bladder, exciting frequent and painful micturition, is a cause of prolapsus at either extreme period of life—the stricture of the urethra, and enlargement of the prostate, as life advances, and the latter especially in old age. The habitual use of copious fluids has undoubtedly a prolapsing tendency.

Internal hæmorrhoids result in prolapsus, by dragging down the *gutta mucosa* with them in their descent; but they may be associated with complete prolapsus of the rectum, the protruded portion forming a nodular zone at the anus, around the base of the protruded gut.

TREATMENT.—Having regard to the causes of prolapsus, its remedial treatment should be both constitutional and local, the latter including the following measures.

The *bowel* must, of course, be first attended to, when in a state of *obstruction*. Reduction is accomplished, in the recumbent position, by gentle and uniform compression of the protruded portion with both hands, and the use of a soft towel or piece of lint to protect the mucous surface, and to prevent its slipping from under the fingers. There may be some difficulty in passing the bowel, when the protrusion is large or the sphincter tight. An *enema* might then be administered to overcome the resistance; or, by introducing the finger into the bowel, it may pass up with the finger and re-descend when it is withdrawn; but, in extreme cases, it may

The CONSTITUTIONAL treatment will vary with the case. A tonic plan of treatment is always appropriate, but the bowels must be specially regarded. In *children*, and especially children of the poor, it will generally be requisite to correct the action of the bowels or diarrhoea, as depending on improper excess of vegetable food. The removal of this cause of action must be coupled with the administration of tonic and the rectification of the intestinal secretions. Perhaps the most useful form of combination is rhubarb, hydrargyrum, carbonate of soda or magnesia, taken as a powder every four or six hours. Ascarides may be the source of irritation in some cases of diarrhoea may be sympathetic as depending on dentition. Habitual constipation usually present must be overcome by senna electuary, or bitartrate of potash; or by mild enemata. Constipation be rectal. Stone in the bladder, enlarged prostate, stricture of the urethra will obviously require attention, and depends on these causes.

LOCAL treatment, of a medicinal character, consists of *astringent injections*, to correct the relaxed state of the mucous membrane. For this purpose, the decoction of oak bark, with alum, and a scruple of the latter to eight ounces of the decoction, is sufficiently astringent; and a third of the quantity enough. The muriated tincture of iron, a drachm to a pint of infusion of rhatany, is an excellent astringent; two or three ounces being thrown into the rectum according to the age of the patient. Infusion of rhatany with tannic acid, may also be employed with advantage. Any enemata should be used cold, and allowed to remain in the rectum for some time. It is more conveniently done at bed-time. Much advantage is gained by the recumbent position, if possible, whenever the patient is in a diseased state of the prolapsed mucous membrane must be treated by ordinary principles. Thus, an ulcerated surface may be treated by a solution of nitrate of silver.

OPERATIONS are resorted to for the cure of inveterate cases of prolapse. They are excision, ligature, and cauterization. The object is

thus forming two oval wounds, longitudinally; and sometimes further portions may require removal. Any bleeding arterial vessels should be twisted or tied; lest hæmorrhage occurring after the operation, bleeding may take place into the bowel and escape observation.

(2.) *Ligature* is especially adapted for a condition of *voluminous* and *lax* mucous membrane—associated with internal hæmorrhoids—but unaccompanied with any or much participation of the anal integument. The operation is easily performed, by seizing with a vulsellum selected portions of the mucous membrane, and casting a whipcord ligature around each; cutting off the ends of thread, and returning the whole within the sphincter.

(3.) *Cauterization*.—Nitric acid is suitable in the same condition as that fitted for ligature; but it is specially applicable when the mucous membrane is extremely *vascular*,—of an arterial character rather than venous, with a velvety appearance; or, again, when the surface has an unhealthy, *ulcerated* appearance. The acid is applied by means of a glass brush; care being taken to protect the surrounding parts with thick oil or grease, and to dab away any excess of acid from the diseased surface. More recently, the actual cautery has been employed for the cure of loose prolapsus, with a relaxed state of the sphincters. A few superficial linear streaks are made in the mucous membrane around the prolapsed portion, and the anus is notched more deeply on either side, with the hot iron. Then the bowel is returned, and kept up with a bandage, until cicatrization may prove a sufficient support.

Polypus of the Rectum.—Any growth springing from the mucous membrane of the rectum, and attached by a narrow and elongated pedicle, is named a *polypus* of the rectum. The tumour, thus characterized by its stalked shape, differs in structure from simple hypertrophy of the mucous membrane, which is also occasionally pedunculated.

Polypus-growth varies in *structure* and *appearance*, forming different species, which have been variously named by authors on this subject. They may be described as—(1) the *vascular* polypus; (2) the *villous*, an extremely vascular growth; (3) the *lobulated*, also vascular, and semi-malignant; (4) the *fibro-cellular* or *mucous* polypus; and (5) the *fibrous* polypus. The first four species are soft in consistence, and the vascular forms are prone to bleed; the fifth is hard, and comparatively bloodless. In point of *situation*, any form of polypus springs from the mucous membrane within the sphincter; but generally at the lower part of the rectum, ranging from about an inch to three inches from the anus. The *size* varies in different species; the ordinary vascular polypus being about the size of a pea or a cherry, the villous species attaining to that of an orange. Polypus-growth is usually single, but more than one or several may form. The period of life varies, and principally in relation to the species of growth. Vascular polypus is the form commonly found in children; other species chiefly in adults.

SYMPTOMS.—The *general* symptoms of rectal polypus are those referable to the presence of a foreign body in the rectum. A sense of *weight* and *fullness*, with tenesmus and mucous discharge, is followed by protrusion of the growth when an evacuation occurs, and spasmodic contraction of the sphincter, if the tumour be situated in the anus or is attached by a long stalk higher up. The pain, which in non-malignant polypus is not

a significant symptom, becomes intense,—when the polypus lies or falls within the grasp of the sphincter, and perhaps gets ulcerated from repeated protrusion. As a growing polypus enlarges, diarrhoea, flatulent distension of the bowels, irritability of the bladder, and other sympathetic affections supervene. *Obstruction* of the bowel produces variously contorted or figured faeces, and sometimes leads to almost complete retention of the faeces, with intestinal distension.

In addition to these symptoms of mechanical origin, *haemorrhage*, recurring from time to time, is characteristic of the vascular forms of polypus, as distinguished from those which bleed less readily. *Malignant* vascular polypus is attended, moreover, with certain peculiar symptoms: pain, lancinating and extending up the sacrum and down the thighs, amounting to *scalding agony* when a motion passes; copious *bloody, fetid, purulent discharge*, as ulceration supervenes; and the *sallow cachectic emaciation* of advanced cancerous disease.

Examination of the polypus-growth will determine the particular species; and this can be accomplished, either by injection of warm water, causing the tumour to protrude with the evacuation, or by examination *in situ* with the anal speculum.

Sometimes *haemorrhoids* are associated with rectal polypus; or, in consequence of prolonged irritation and repeated straining, fissure may supervene, or abscess and fistula in ano. Occasionally, a slender-stalked polypus gives way during an action of the bowels, and thus a natural cure has been effected.

TREATMENT.—Removal of the growth offers the only prospect of cure. *Ligation* is preferable to excision, particularly as regards the vascular forms of polypus. The bowels having been acted on as far as possible, to prevent the necessity of any relief for some days after operation, the tumour is made to protrude as for examination, when it must be seized with a vulsellum and drawn down, until its peduncle is fairly seen; a ligature is then applied around its origin, and the stalk cut off beyond by a pair of scissors, observing not to cut too closely lest the ligature should afterwards slip off. A broad-stalked polypus had better be transfixed at its base, by a needle carrying a double ligature; each portion is then tied. When situated high up the bowel, and out of reach with the fingers, the ligature must be passed by means of a double cannula, or through a gum-elastic catheter, as in ligaturing polypus of the uterus.

Stricture of the Rectum.—The rectum, like other mucous canals, is subject to contraction or narrowing of its calibre. This state may result from either of two conditions,—*simple fibrous thickening*, or *chronic thickening of the coats of the bowel*. These two conditions of stricture differ widely in their nature, symptoms, and treatment.

(1.) **Fibrous Stricture.**—This condition of stricture presents a *prominent ring* within the cavity of the rectum, entirely or partially surrounding the cavity of the bowel. It consists apparently of a *fold of thickened mucous membrane*, but principally of *fibrous condensation of the submucous cellular tissue*; occasionally, there is co-existing *hypertrophy of the muscular coat*; rarely any change in the peritoneal investment, which generally remains its healthy structure. The structural alteration is *unobscured* limited in extent, presenting an *unequal stricture*; moreover, the induration extends from half an inch to two or more in

length, reaching perhaps to three or four inches, or even nearly the entire length of the rectum. If the thickening is greater on one side of the bowel than the other, the passage assumes an irregular winding shape. The *situation* of fibrous stricture is commonly at the *lower part* of the rectum, from an inch and a half to two inches from the anus, and easily within reach of the finger; next in order of frequency, at two to three inches from the anus; then at four or five inches; and sometimes at the junction of the bowel with the sigmoid flexure of the colon. Very rarely, two distinct strictures have been met with. *Above* the seat of stricture, the rectum is usually dilated, and thickened just above the part diseased. This thickening is owing to hypertrophy of the muscular coat, in consequence of the increased functional action of the bowel at this point to overcome the obstruction. The mucous membrane, above the stricture, is seldom healthy; being either unduly vascular, or ulcerated and pus-discharging. *Ulcerated* apertures may at length lead downwards along *stulous passages* which open externally near the anus, or in front of the perinæum, or behind, as far off as the buttock. Sometimes, a fistulous communication forms between the rectum and the vagina or the urethra, or between the bowel and the cavity of the peritoneum. *Below* the stricture, the coats of the bowel are less changed; but there is frequently *diffuse ulceration* of the mucous membrane, perhaps *hæmorrhoids*, or a *complete fistula* in ano.

SYMPTOMS.—Stricture of the rectum commences insidiously. The earliest symptom is that of some *mechanical obstruction* to the passage of the fæces in the act of defæcation. Hence, frequent constipation ensues, with straining efforts at stool. This difficulty may be readily overcome by a solvent purgative, and the nature of the case remain unsuspected. At length some pain is experienced, especially in the act of evacuation, owing to an inflamed state of the mucous membrane, from repeated pressure of the fæces in passing through the strictured part. And the motions become more scanty, narrowed or figured, and often voided in small lumps. Fæcal and flatulent accumulations above the stricture give rise to abdominal distension; while an irregular, feculent, and mucous diarrhœa occasionally relieves the otherwise habitual tendency to constipation. In the *ulcerative* condition, scalding pain, and bloody, slimy, mucous or purulent discharge, are superadded to the symptoms of obstruction. *Examination per rectum* will affirm or negative the presence of stricture. On introducing the forefinger into the rectum, the stricture can generally be felt; when its nature—whether fibrous or malignant—perhaps the degree of contraction and its extent, may also be determined. If situated beyond the reach of the finger, the introduction of an oiled wax or gum-elastic bougie may possibly enable the Surgeon to ascertain the presence of a stricture, but not its nature; also its height from the anus, the degree and extent of contraction,—by observing the relative size, and length, of the obstructed portion of the bougie. In using the instrument, all these particulars must be gained very cautiously; the *curve* of the rectum from before backwards, and its inclination to the left high up, being duly remembered; also the promontory of the sacrum, against which the point of the bougie is apt to impinge; and the presence of the *natural folds* of mucous membrane which may intercept its progress.

In the **DIAGNOSIS** of stricture of the rectum, sources of compression

external to the bowel, from diseases of the adjoining viscera, must not be overlooked, as conditions to which the symptoms may be referable. Such are enlargement or tumour of the prostate, retroversion or backward flexion of the uterus, or an ovarian tumour.

The CAUSES of fibrous stricture relate to its pathological origin. It proceeds from *chronic inflammation* of the mucous membrane and sub-mucous cellular tissue; resulting in fibrous deposit, especially affecting the latter texture. *Syphilis* has undoubtedly been known to produce stricture of the rectum, either as a primary or secondary affection. *Ulceration* or abrasion of the mucous membrane, resulting in contraction, may also produce stricture. The *exciting* causes are necessarily various; any source of *irritation*, as the impaction or passage of hardened faeces, foreign bodies, as fish-bones, etc.; or the straining efforts in forcible defecation. In *women*, difficult parturition or the unskilful use of instruments for delivery may induce inflammation.

TREATMENT.—The principle of treatment is mechanical *dilatation* of the stricture. Considerable judgment will be requisite in carrying out this treatment. Besides attention to the natural course and character of the canal and the nature of the stricture, two additional rules should always be observed in using dilatation,—namely, never to make any forcible effort, and never to cause pain, nor the risk of hæmorrhage, which might be perilous. The instrument used should always pass with ease.

When situated *low down*,—generally within reach of the finger, *dilatation* can be effected with tolerable facility, by the introduction of a proper-sized gum-elastic bougie, or compressed sponge-tent. Either form of dilator must be allowed to remain in the stricture; the bougie for ten or fifteen minutes, the tent may remain for twelve or twenty-four hours. Dilatation must be renewed every two or three days, and with instruments of progressively increasing size. Tent-dilatation is, however, the most effectual, owing to the swelling character of the compressed sponge. A very tight annular or almost membranous stricture may be advantageously *notched* with a protected bistoury,—my “concealed fistula-knife” being serviceable for this purpose. The posterior aspect of the canal is the safest for a slight incision, not to endanger the peritoneum. Dilatation can then be accomplished by widening the seat of contraction with the forefinger of each hand, introduced into the bowel; and maintained by a bougie or tent.

If the stricture be situated *high up*, the same treatment may be adopted, but with very great caution. A wax or a very flexible gum-elastic bougie should be used. Pain or spasm following the use of instruments admits of relief by the occasional introduction of opiate suppositories. Constipation often remains, even after dilatation of the stricture; but as the result of loss of power in the distended bowel above the seat of obstruction, the action of the bowel will perhaps be restored by tonics, and oleaginous enemata; or it may be preferable to administer castor oil in small doses daily, or a lenitive electuary of senna and sulphur, thus to obtain a regular soft evacuation. Cod-liver oil seems to be laxative as well as nutritious; and in any case, the diet should be carefully regulated, to avoid any accumulation of hard, indigestible food. But, however temporarily successful dilatation may prove, a permanent cure is seldom if ever effected.

Palliative treatment affords relief to the pain, with perhaps spasm, and discharge. Rest, in the recumbent position, is thus most advantageous. Nitrate of silver, in the proportion of five grains to the ounce of distilled water, or the mild citrine ointment, may be applied to the diseased mucous membrane within the stricture, by means of a camel's-hair brush passed through an anal speculum. Hæmorrhage may be restrained by cold water, solution of alum, or other styptic injection, administered through a long tube. Plugging the rectum will be necessary, in the event of any serious or persistent hæmorrhage, such as would be consequent on forcible dilatation. Fæcal accumulations, above the stricture,—sometimes forming a considerable mass, require to be removed. This may be accomplished by tepid injections of soap and water, taking care to pass the flexible catheter or other tube through the stricture, in order to soften the scybala, and then wash out the dilated portion of gut.

Any *fistulous* passages which may have formed in connection with the dilated portion of gut above the stricture will, of course, be incurable, unless the contraction on which they depend can itself be overcome. In such cases of complicated rectal stricture, the operation of *linear rectotomy* will be appropriate. It consists in completely dividing the stricture—in its length and depth, including the anal portion of bowel down to the coccyx. This is effected by a posterior median incision, the patient being placed in the lithotomy position. A long-bladed knife, under cover of the finger, is passed up the bowel to above the stricture; then, turning the edge backwards, the *stricture* is fairly *divided*, and the *anus* laid *open*. The vent thus given to discharge, is sometimes followed by almost immediate improvement of the general health, with closure of the fistulous channels, and cicatrization of the wound without the return of stricture.

In this operation, the *écraseur* or the galvanic wire-cautery has been used to divide the terminal portion of bowel, which is looped by puncture from within, at the coccyx. But the hæmorrhage, even when free, is sufficiently under control low down, to render this precaution unnecessary; and higher up, in the seat of stricture, bleeding must be stopped by plugging. The operation is, of course, inadmissible when the stricture is so high as to endanger the peritoneum.

In extreme cases, of almost complete obstruction, Amussat's operation of *colotomy* must be resorted to.

(2.) **Cancerous Stricture.**—The coats of the rectum are liable to the formation of every species of cancer—scirrhus, encephaloid, colloid, and epithelial; resulting severally in stricture of the bowel. Any such growth forming external to the rectum may so press upon and implicate the bowel, as to have the same effect. The disease is usually *situated* at the *lower part* of the rectum, within three inches from the anus, and rarely begins at, or tends to involve, the anus; less frequently than in the rectum, it occurs at the junction of the sigmoid flexure of the colon; but any portion of the bowel may be affected, and to a variable extent; so that when the stricture is seated quite low down, the finger may pass through the contracted part or not reach its upper border. In some cases, the cancer-growth is limited to part of the circumference of the gut; thus causing more or less obstruction in the passage, but no actual stricture.

SYMPTOMS.—Commencing insidiously, the early or mechanical symptoms of obstruction are similar to those arising from fibrous stricture. But the *excruciating pain*, its lancinating character, darting up the sacrum and extending down the limbs, the aggravated intensity of the pain, as of molten lead, when the feces pass, and especially when ulceration has supervened, with the increased tendency to *hemorrhage*, and copious, *fetid, purulent discharge*;—these symptoms are more or less diagnostic of cancerous stricture. Subsequently, the peculiar cachectic appearance and emaciation are distinctive constitutional symptoms. *Examination per rectum* will probably determine the diagnosis. If the disease be situated as usual—low down—on introducing the finger into the bowel, considerable thickening of the bowel and narrowing of the passage are felt; but the consistence of this diseased portion of the bowel differs widely; the resistance being that of *cartilaginous induration*—in scirrhus stricture; and resembling a *soft cushion*—in encephaloid or other soft cancerous stricture. If the finger can be insinuated into the stricture, an *irregular mottled surface* is felt, and which is more extensive than usual in fibrous stricture, so that the whole extent upwards of the diseased portion of bowel cannot perhaps be ascertained. Sometimes nodules, hard or soft, are found, round about the seat of stricture. In some cases also the bowel is not contracted, for the cancer-growth may be restricted to a portion of the intestinal wall,—although eventually perhaps involving the whole circumference. In all cases, having finished the rectal exploration, on withdrawing the finger, it is covered with blood and pus. *Fistulous communications* form between the bowel and adjoining parts,—the vagina, bladder, or urethra, which also become implicated. *Feculent matter* being discharged through any such fistulous passage, at once indicates its communication with the bowel, above the seat of contraction; but the relief of pain by this diversion of the alvine evacuations, is less marked in cancerous stricture, which is itself so inherently painful. The lymphatic glands in the neighbourhood of the rectum become enlarged, and secondary cancer may be speedily developed in other internal parts,—the lungs, pleura, peritoneum, or liver. Death results from fecal obstruction, or from these complications; the disease running its natural course usually in about two years.

The liability to cancer of the rectum varies with the *period of life*, and sex. It occurs generally in middle life, and women are said to be more subject than men. This latter predisposition seems doubtful. *Hereditary predisposition* can rarely be traced.

Treatment.—*Palliative measures* consist chiefly in a light nourishing diet and a tonic course of treatment; with regulation of the bowels and solution of the mass by castor oil or other mild aperients; and opiates administered internally, and per anum by injection or suppository, or by the hypodermic method, to soothe pain. Chloroform applied locally to the seat by means of a piece of lint covered with oiled silk, or inhaled as usual, has given marked ease, although not pushed to the extent of insensibility; and its anæsthetic influence may be had recourse to daily, if necessary.

The introduction of any instrument is always hazardous. Bougies and such sort not to be thought of. Feculent accumulations above the stricture may sometimes be reduced by passing a long tube through the

stricture, and then giving an injection of warm water. But this proceeding must be conducted with the utmost caution.

EXCISION OF THE CANCEROUS MASS.—The intestinal canal having been well cleared by an oleaginous or other aperient, and the rectum emptied by an injection on the day of operation, the patient, when under the influence of chloroform, is placed in the lithotomy position; then, a *median incision* is made from the posterior commissure of the anus backwards to the tip of the coccyx,—so as more readily to gain access to the bowel; steadying the part with the left hand, the scalpel is carried from this incision forward around the anus, on either side, to the middle line in front—thus forming *two crescentic* incisions enclosing the bowel, and observing to include so much of the anal integument as shall make the excision clear of the disease. The bowel is dissected out of the ischio-rectal fossa on either side, and also detached behind; then, pulling the mass *well down*, it should be cautiously separated in front, turning the edge of the knife *towards* the *bowel*, not to wound the prostatic urethra and neck of the bladder. I here use the handle of the scalpel, rather than cut too freely; and it may be a safe precaution to introduce a full-sized catheter into the bladder, thus to define the urethra. When the whole of the diseased bowel has been reached, the loop of an *écraseur*—wire or chain—is passed above, and the instrument worked slowly in completing the excision through the gut. No attempt should be made to bring the bowel down to the former situation of the anus, either in completing the operation or by a subsequent connection of the integument; any such procedure will prove abortive.

The *conditions* favourable for the success of this operation relate to the extent of the disease, and the implication of adjoining parts by cancerous adhesions and infiltration. The disease should not extend too high up the bowel,—beyond the reach of excision without opening the peritoneum,—not further, therefore, than four inches, and less than that distance on the anterior wall of the bowel in relation to the bladder; and the diseased mass should be movable up and down, and from side to side,—when examined in the perinæum, or explored within the rectum. Of course, any evidence of secondary cancer-formation, as in the liver, would at once forbid operative interference.

Peritonitis is the usual cause of death; pyæmic infection being rare. The *return* of the disease is perhaps invariable; but in twenty-five cases Mr. Cripps states that recurrence had not taken place in eleven instances, after intervals varying from a few months to some years; although in the remaining fourteen patients, the disease returned after from four months to three years.

COLOTOMY, in the left loin, may be resorted to when excision is impracticable; the whole of the cancerous portion of bowel not being within reach of removal. The results of operation have been encouraging,—both for the relief of the excruciating pain during evacuation and the other rectal symptoms, and in the duration of life.

Rectal Fistulæ.—Fistulous communications are liable to form between the rectum and adjoining organs: the bladder, as Recto-vesical Fistula, in the male; and the vagina, as Recto-vaginal Fistula, in the female.

(1.) **Recto-vesical Fistula** is not often met with. It may result

recumbent, with the legs raised and held apart, and the buttocks edge of the table, as for lithotomy. The Surgeon sitting opposite the patient, he freely pares the margin of the opening (Fig. 127); the edges are brought into even and easy apposition, transversely to the axis of the vagina; to effect which it is necessary to divide the sphincter on either side, in order to overcome spasm, and spasmodic muscular contraction after the operation. The sides of the wound are evenly secured in apposition by means of silver or platinum wire sutures; taking care to transfix the whole thickness of the gut, *excluding* its mucous membrane, and observing to bring the edges through the vaginal mucous membrane half an inch beyond the pared edges, above and below. The suture-wires are secured by a close twist of the wire across the wound aperture, or they may be passed through a perforated leaden shield, over the aperture, then through split shot, and are clamped with forceps close upon the shield, so as to fix it upon the vaginal wall.

But the latter mode of closure is seldom practised. The ends of wire are whipped, and the operation completed. The post-operative treatment is most important. It consists in preventing any action of the bowels for a week or ten days, by keeping the patient under the influence of opium, until firm union is established. A saline aperient, or an enema of castor oil and gruel, may then be administered. Cleanliness is also essential to success; the vagina being washed with cold water two or three times a day, and the urine drawn off by a catheter as occasion requires. About the end of a week, the suture may be snipped through, and gently withdrawn.

1) **Entero-vaginal Fistula** is a rare occurrence; a communication having been formed between the small intestine and the vagina. This condition would simulate a recto-vaginal fistula; but it may perhaps be distinguished by the feculent discharge having a more yellow colour, and a more mucous character.

2) **Anal fistula is incurable.**

Anal Tumours.—Various forms of tumour and excrescence are liable to beset the Anus. They are principally—*epithelial cancer, fibrous tumour, warts, and condylomata.*

The **TREATMENT** is excision, which may generally be effected most advantageously by a stout pair of scissors curved on the flat. Chloroform, if used, and salt, or the ether-spray, will be requisite; the operation being very painful, and spasmodic action of the sphincter interfering with performance. Wet lint-dressing is often sufficient; but a persistent hæmorrhage must be arrested by application of the perchloride of iron, or other styptic, and sometimes by the actual cautery, with a com-

FIG. 127.



press and T-bandage. Great cleanliness should be observed, to prevent any irritation which might induce reproduction of the morbid growth.

Anal Contraction, or stricture of the anal orifice, results from tight cicatrization, in consequence of the healing of ulcers or wounds of the anal integument. This may take place after operations of excision; or the removal of external piles, or of anal tumours.

The **Treatment** is dilatation, gradually effected by bougies or compressed sponge-tents. In obstinate cases, the sphincter ani may be divided, by passing a straight probe-pointed bistoury flatwise, under cover of the finger, up the rectum, and then turning the edge towards the firm ring, dividing it on one side, as the knife is withdrawn. Division of the sphincter towards the perineum, in the female, entails fecal incontinence as a permanent result.

CONGENITAL MALFORMATIONS OF THE ANUS AND RECTUM.

Imperforate Rectum, as a congenital malformation or deficiency, may exist in two primary conditions: **IMPERFORATE ANUS**; or, the anus leading into a cul-de-sac, **IMPERFORATE RECTUM**. The former condition—**imperforate anus**—presents five varieties: (1) simply membranous obstruction of the anus; (2) with partial or complete deficiency of the rectum; (3) communication with the neck of the bladder or the urethra, in the male; (4) communication with the vagina, in the female; (5) external communication, or fistula. The latter condition—**imperforate rectum**—presents two varieties: (1) membranous obstruction; (2) partial or complete deficiency of the rectum.

Signs.—When, after birth, there is no evacuation, during the first thirty-six or forty-eight hours, of the usual dark-coloured meconium stool, and perhaps sickness co-existing, the medical attendant or the nurse is



FIG. 128 *

led to discover that the anus is *imperforate*; if indeed this deficiency had been overlooked at the time of birth. The condition of the rectum, when obstructed, is almost sure to be undiscovered at birth; but if no *bulging* in the fundament be perceived after some hours have elapsed—the anus being *imperforate*—the lower end of the rectum will probably be deficient also (Fig. 128). *Imperforate rectum* is distinguished by the presence of an *anal cul-de-sac*. The finger can sometimes be introduced into this sac to the extent of its depth,—half an inch to an inch and a half. These varieties of *imperforate anus* in which a communication exists with

the bladder, the vagina, or externally, admit of less direct recognition during life. But the discharge of feculent fluid through the urethra, the vagina, or an external fistulous opening, will be severally diagnostic of these

* London Hosp. Mus.

malformations. In the latter state, the situation of the opening varies in the two sexes. In the *male*, the fistulous opening may be in the perinæum just behind the scrotum, in the scrotal raphé, or anterior to the scrotum. In the *female*, it occurs in the perinæum close to the vagina, or at the posterior commissure of the vulva. In both sexes, and in all these situations—vesical, vaginal, and perineal—the vent is insufficient and defæcation more or less difficult. Hence, constipation and intestinal distension ensues, especially as the fæces acquire consistency, and sooner or later life becomes endangered.

All the foregoing malformations seem to occur more commonly in male children than in female.

TREATMENT.—Operative interference is necessary or becomes necessary to preserve life, in consequence of the anal or rectal obstruction; or to remove a wretched and disgusting infirmity, in the cases of fistulous communication, vesical or vaginal, or of an external perineal opening. The principle of operation is to remove the obstruction by the formation of an anal opening in the situation of the natural anus,—the establishment of an *artificial anus* in the natural situation; or by the *enlargement of a fistulous communication* at some distance off; substitute procedures being, an artificial anus in the left iliac region or the left lumbar region, respectively, by Littre's or Amussat's operation of *colotomy*.

IMPERFORATE ANUS, as a simply *membranous* obstruction, may be easily remedied. The integument over the seat of the termination of the rectum is usually so thin that the meconium can be distinguished by the dark-blue or black colour of the skin; and bulging becomes plainly visible when the child cries. A *central crucial incision* should be made with a sharp-pointed bistoury, and the four angles of the integument excised. The aperture must then be maintained by the introduction of an oiled tent or the passage of a bougie daily, until the anus is fully established, which seldom requires more than a week.

Deficiency of the Rectum, co-existing with imperforate anus, should be managed on the same principle. An *incision* is made at the site of the anus, exactly in the *middle line*; and then the dissection must be prolonged cautiously *towards the coccyx*, extending to the depth of an inch and a quarter. The closed termination of the bowel may thus be reached, or in the course of a few hours it comes into view, being forced down by the infant's crying. When reached, the *bowel* must be opened freely with the bistoury, then *drawn down* to the external wound, and there attached by sutures. After this procedure, the same precaution will be requisite as before, in order to see that the anus shall become permanently established; a bougie should be passed occasionally for several weeks. In the event of a failure to reach the bowel, *colotomy* must be performed, in the *left iliac region*.

IMPERFORATE RECTUM—the anus opening into a cul-de-sac—necessitates similar operative interference. By *dilating the cul-de-sac* with a sponge-tent, for a few hours, the seat of operation is rendered more perceptible. Then, on introducing the finger into the anal cul-de-sac, if the obstruction is *membranous*, the termination of the distended rectum can be distinctly felt as a thin septum under the point of the finger. This may be opened by an *exploratory puncture* with a grooved needle or fine trocar, and if meconium fluid or gas escape, a *free aperture* should be made with a

sharp-pointed bistoury. If the distended end of the bowel cannot be felt, the anal cul-de-sac should be enlarged by an incision, carried towards the coccyx, so as to divide the *posterior wall* of the sac; and search made in this direction to the depth of an inch and a half or two inches from the anus. Having opened the bowel, above the occlusion, the *mucous membrane* must be drawn down to the skin and there attached with sutures. But the formation of an artificial anus, in this condition of imperforation, may be impracticable, owing to the depth of the bowel. A more simple method of operation—without dilatation or external incision, may, however, enable the Surgeon to reach the bowel, without risk. In a case where the anal cul-de-sac was not larger than a small quill, I passed a *director* down, to the extent of two inches, and distinctly felt the tense drum-head of the imperforate rectum; then sliding a tenotomy-knife to that point, a slight incision downwards and backwards gave vent to the meconium fluid.

Failing to reach the bowel, further operation should be abandoned, and *colotomy*, in the *left iliac* region, resorted to; or the *deeper* the imperforation, *lumbar colotomy* will be more judicious; in order to be thus more certainly free of the occluded portion of rectum.

RECTAL COMMUNICATIONS with the Bladder, Vagina, or Perinæum—co-existing with imperforate anus—may require operative interference, eventually, to preserve life, as constipation and intestinal dilatation supervene; and in any such case, interference will be justifiable to relieve and render tolerable the otherwise wretched state of existence.

(1.) In the case of a communication with the *bladder*, the opening is situated at the neck of the bladder, or more commonly at the anterior part of the prostatic portion of the urethra; it is not usually direct, but through the medium of a narrow channel, and is always small and insufficient. But the urethral aperture appears to be usually of a valvular character, so that, although *fæces* can pass into the urinary canal, the urine is unable to enter the rectum. The same operation should be performed as in the condition of imperforate anus coupled with deficiency of the rectum. The *end* of the bowel should be brought down and secured to the integumental wound at the site of the anus. A passage lined with mucous membrane is thus made for the escape of the *fæces*, and the liability of feculent extravasation averted, and its consequences, diffuse cellulitis and peritonitis. *Colotomy* must be had recourse to, when the bowel is seated at a depth beyond an inch and a half to two inches.

Rectal communication with the *vagina*, or a fistulous opening in the *perinæum*, may be remedied by either of two operative procedures—enlargement of the original outlet, or the formation of a new anus at the natural site, and closure of the abnormal anus.

(2.) Recto-vaginal communication has been cured in both ways. 1. *Enlargement* of the original outlet is effected by division of the posterior wall of the vagina and the perinæum as far as the coccyx, and retaining a cannula in the bowel. 2. To establish a *new passage* at the natural site, a curved director or sound should be passed through the vaginal opening into the bowel, with its point directed to the site of the anus; this is then cut upon in the middle line, the incision being carried backwards towards the coccyx. A free opening having thus been made in the *bowel*, it is brought down and secured by sutures to the margin of the integumental wound. Dilatation must subsequently be maintained. Closure of the

abnormal communication with the *vagina* may take place spontaneously, after the substitution of the operation-anus. Generally, it will be necessary to assist contraction and closure by touching the edges with the actual cautery; or, if the opening be large, the edges must be pared and brought together by sutures. After either procedure, the bowels should be kept at rest by opiates, for several days, until closure has taken place.

(3.) *Recto-perineal* communication, as the third variety of imperforate anus, has also been treated successfully by both modes of operation. 1. *Enlargement* of the original outlet is performed by an incision towards the coccyx, and the application of sutures. Successful results have been obtained. 2. The formation of a new anus at the natural site has also proved successful. But enlargement of the original outlet will be *preferable* in all cases where the opening is sufficiently near the site of the natural anus; this is generally the condition in the female, and sometimes in the male. When, however, the opening is situated beneath the penis, or in the *scrotal raphé*, the other operative procedure must be resorted to.

CHAPTER LI.

RENAL CALCULUS—STONE IN THE BLADDER— LITHOTOMY AND LITHOTRITY.

URINARY DEPOSITS, and CALCULI,—their origin, and formation, their Physical and Microscopic characters, Chemical composition, and Tests, are fully described in the Author's "Surgery."

Renal Calculus.—A stone forming in the pelvis of the kidney may, or may not, be attended with pain or other symptoms of nephritic irritation. Frequently it remains quiescent and unsuspected when lodged in this dilated portion of the ureter. It may there attain a large size and remarkably irregular shape, being moulded to the pelvis and calices of the ureter within the hilus of the kidney. Absorption of the kidney-substance results from the continued pressure, and this is attended with pain in the lumbar region and symptoms of nephritis. In rare cases, abscess has been known to ensue and the stone be discharged through an aperture in the loin.

A *small* stone in the pelvis of the kidney usually descends through the ureter into the bladder; it gradually increases in size, as a vesical calculus, by accumulating concretion on its surface.

SYMPTOMS.—The *descent* or passage of a renal calculus is accompanied with more or less severe pain and constitutional disturbance, according to the size and shape of the stone. A *small, smooth* stone may descend without occasioning any notable suffering. A *larger-sized* and *rough* stone, as a mulberry calculus, descends with much difficulty and causes proportionate agony. After perhaps some symptoms of nephritic irritation, the patient is seized with sudden and excruciating *pain* in the *loin*, extending down the course of the spermatic cord to the *testicle*, which is often *retracted*, and down the thighs. This agony may, as it is said, "double the patient

...the symptoms... And origin, charac-
ter of the symptoms determine the *diagnosis*.
calculus becomes impacted in the ureter, and symptoms
venae. Stricture of the ureter may result from the pas-
calculus; or, when, occasionally, it remains impacted in
tube is gradually much dilated above, while the kidney
and degeneration. When the stone has become vesical,
the bladder, the symptoms of Stone in the Bladder begin.

TREATMENT.—Only palliative measures are available
most efficacious anodyne for assuaging the nephralgic
patient can be kept under its influence during the whole
the stone. Chloroform may, however, be administered
from time to time, as a relaxant. The *warm bath* is also
able adjunct. Cupping in the loins, followed by warm
afford some relief. The bowels should be thoroughly
ologous enemata, and diluent drinks freely allowed.

Stone in the Bladder.—**SYMPTOMS.**—(1.) The
stone-formation in the bladder are very insidious.

Take, for example, the ordinary case of uric-acid or
formation. *Uric acid* appears in the urine, as a brick-d-
or less persisting. Soon after a small *bit of gravel* passes,
a marked attack of *renal pain*; after an interval, anot
little stone passes, and then no more for a few months,
now too large to pass through the urethra; but in the
stone is growing by accretion, and consuming surplus u
purpose day by day. *Frequency of micturition* is experi
day, during movement, than by night, during rest. A
more passing sting—is mostly present at the close of the s
in the end of the penis. Then some day, after an unusual
be after an hour or two in the saddle, a *little blood* is obser
first passed afterwards. Under these circumstances, t
a small stone in the bladder may be strongly suspected.

(2.) The symptoms—when developed—arise from the n
tion, and the obstruction caused by the stone as a fore

articular. In addition to these four symptoms, which severally may rise from other causes than stone, there is the physical sign of a hard body elicited by *sounding* the bladder with a metallic instrument, whereby stone can be felt and heard when struck,—the sensation and sound as of stone being transmitted through a metallic instrument to the hand and ear. This touchstone, as to the presence of a calculus, is conclusive, when available; and it alone is far more *diagnostic* of stone than all the mere functional symptoms of its presence.

In an *early* stage of stone-formation, the *state* of the *urine* may be taken as partly an indication of the *kind* of calculus in the bladder. 1. When the urine is *clear*, and of a *bright amber* or golden colour, the stone will probably be either *uric acid* or *oxalate of lime*; 2. a *turbid* urine, with a constant deposition of urates, in the form of *reddish* or pink-coloured *sand*, is associated with a calculus consisting of *urates*. As these three kinds of stone increase in size slowly, the corresponding states of urine in such cases may continue for a period of some months or longer. At length, however, the stone acquires sufficient size, and roughness of surface—in the case of oxalate of lime, to induce cystitis,—from the prolonged irritation of the bladder by a foreign body; and inflammation of the vesical mucous membrane—*cystitis*, is attended with a deposition of phosphates in the form of *white sand*, mingled with *mucopurulent matter*, the urine becoming turbid, and of an orange-brown colour. In such case, the urine is *ammoniacal*, and the deposit consists of the ammoniaco-magnesian phosphates. *Phosphatic* urine having reference to an *alkaline* state of this secretion—not from ammonia, is also accompanied with a deposit of white sand, consisting of the phosphates of lime and magnesia, which are insoluble in alkalis; but this is unaccompanied with mucopurulent matter, the urine becoming only slightly turbid, and of a pale yellow or grey colour. In either case, phosphatic deposit encrusts the original stone-formation—whether uric acid, or oxalate of lime; and the urine bears evidence of this change in the calculus, which now grows more rapidly, and may attain to a large size.

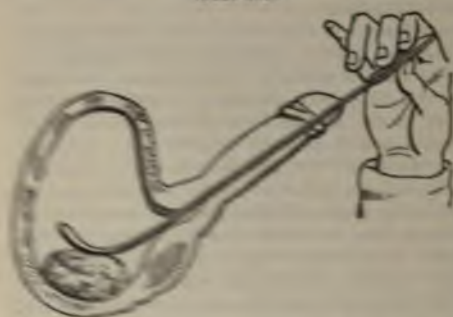
SOUNDING THE BLADDER.—A *sound* is a solid steel instrument, shaped like a catheter; but with a shorter curve, and having a bulbous extremity, and a broad, flat, or round handle.

Sounding is performed in the following manner, chloroform having been administered, only when the bladder is unusually sensitive or irritable and spasmodic, or the patient too restless for examination:—The bladder should contain three or four ounces of urine, or having been distended to that amount by injection with warm water, and the patient lying in the semi-recumbent position, the instrument is warmed conveniently by slipping it up the arm of the operator for a few seconds, then well oiled, and passed gently along the urethra into the bladder. Its cavity is explored—first, along the *inferior surface*, by raising the handle of the sound and passing its convexity from the neck of the bladder in a *sweep backwards* (Fig. 29); then, the bladder should be explored laterally, by *revolving* the handle from side to side between the fingers and thumb; lastly the instrument should be withdrawn to the neck of the bladder, and the *point* turned *downwards* to the depressed space behind the prostate, and then *upwards* to behind the pubes,—the free movement of the beak in the former situation, or its reach upwards in the latter part, being facilitated.

by depressing the handle of the instrument between the thighs, space behind the prostate may sometimes be advantageously tiltedwards by introducing the finger into the rectum; a proceeding requisite in old persons.

In all these manoeuvres, the instrument is used with a gently to

FIG. 129.



motion, in order to strike the stone, avoid any rough manipulation as the bladder is very sensitive and disposed to bleed, and long-continued irritation. Failing to discover it in the recumbent position, the bladder may be sounded with the patient standing up, with a more or less moderately distended state of the bladder. These resources may fail to present

success, a second exploration may be made in the course of a few days.

The knowledge gained by sounding comprises more than the mere presence of a stone. 1. Its situation is generally found to be on one side of the neck of the bladder, more frequently to the right; or, small-sized, it usually lies backwards towards the fundus, or buried in the space behind the prostate. (See Fig. 129.) 2. Its size is less ascertainable; but this may be guessed by observing the extent of surface over which the sound passes, and the readiness with which sound is found in all conditions of the bladder; while the resistance offered by the stone to move it from its position, will afford some estimate of its weight. By introducing a lithotrite, the dimensions of the calculus may be measured in all directions, as indicated by the separation of the blades, and in raising the stone from the base of the bladder, an experienced hand will thus also somewhat appreciate its weight. The size and weight of the stone together represent the quantity of matter—a very important consideration relative to the amount of debris which would have to be evacuated from the bladder, were lithotomy performed. 3. The shape of the calculus, whether rough or smooth, is tolerably perceptible by touch. 4. The density or hardness of the stone can be estimated possibly by the sound elicited on percussion with the instrument—the sounding. A hard calculus, as the oxalate of lime or a uric calculus, rings when struck, so as to communicate a click audible by another at perhaps a distance of some yards off; a soft calculus, consisting of phosphates, conveys a dull earthy sound, perhaps scarcely audible to the operator. The gritty rough sensation and slight sound communicated by a backward bladder, covered with phosphate deposit, must not be taken for a distinct calculus.

5. A second calculus, or the presence of several calculi, can sometimes be distinctly detected by twirling the sound, a stone perhaps by

each side of the bladder; the introduction of a *lithotrite* will, however, surely determine the question, when one stone is seized and another struck with the instrument still holding the first in its grasp.

Sounding is an operation not wholly free from danger. It may induce cystitis and peritonitis, terminating fatally. Hence, caution and gentleness should be observed in the practice of this familiar procedure. Nor should the shock as from injury be overlooked, as occurring in some cases; although under anaesthesia, when necessary, this contingency may be mitigated or averted.

Enlargement of the Prostate renders all the *symptoms* of stone *less pronounced*. The calculus lies usually in a receptacle behind the elevated prostate,—especially when the middle lobe is enlarged; being thus removed from the *sensitive vesical neck*, the pain in the glans penis, and the vesical irritability with increased frequency of micturition, are much relieved; the imbedded stone is less apt to fall over the vesico-urethral orifice, and suddenly obstruct the stream of urine in micturition; and bloody urine is less liable to occur from movement in the bladder. In *sounding*, the convexity of the instrument may glide over the stone, in its receptacle, which thus escapes detection. A short sound should be used, curved or beaked, and turned down into the post-prostatic hollow.

ENCYSTED CALCULUS is so named when the stone is lodged in a cyst or pouch of the mucous membrane, between the muscular fasciculi of the bladder. The *symptoms* of a stone—as caused by a loose, hard body rolling about in the bladder—are necessarily *absent*. There may be some pain and weight, with increased frequency of micturition, arising from the irritation of a foreign body; but there cannot be any aggravation of these symptoms after each act of micturition, and much increased by any jolting exercise—the stone being stationary; nor any sudden stoppage of the stream of urine, and constant liability to the admixture of blood. Then, again, *sounding* gives less positive evidence as to the presence of a stone.

The *encysted condition* may be suspected, if the stone be struck just once in a way—when its exposed surface is *hit by chance*, and if it be always found at the *same part* of the bladder, being also *immovable* from its position; or if the stone can sometimes be easily felt, and at other times not felt at all, owing to its escape occasionally into the bladder and back again into the cyst. A large encysted calculus, having been struck, may perhaps be defined with the bulb of the instrument; not as an isolated stone, but through the mucous membrane, as a projecting tumour. This comparative absence of symptoms occurs also when a calculus, at first loose in the bladder, *afterwards* becomes encysted.

DIAGNOSIS.—(1.) The symptoms of stone, taken *severally*, may, when present, be due to other diseases of the bladder. 1. A *pedunculated growth* from the middle lobe of the prostate, or in the bladder, is apt, during micturition, to flap over the urethral orifice and thus abruptly arrest the flow of urine. 2. *Ulceration* of the prostate, or malignant disease of the bladder, both give rise to hæmorrhage. 3. Lastly, the pain and vesical irritability may be due simply to *cystitis*, or signify *neuralgia* of the vesical neck; or be *sympathetic* only of an impacted and inflamed testicle within the inguinal canal, in the more rare case of undescended testis. We should therefore not be misled by the presence of any one symptom,

...irritation, or other causes of inflammation at an early period of life. In adult and old age, constitutional predisposition, and hereditary disposition—should also be taken into account.

DIFFICULTIES and sources of fallacy in the way of cure are enumerated: 1. a large and deformed bladder; 2. a bladder unable to contain fluid; 3. a sacculated or irregular, hour-glass contraction of the bladder; 4. passage of the sound into one of the compartments; 5. adhesion to the walls of the bladder; 6. calculi in the prostate, enlarged and roughened prostate, and tumours at the neck. The calculus itself may be coated with blood.

In the *female*, the symptoms of stone are similar to those in the male. If the stone is small, and the neck of the bladder is very easily accomplished, the straight and slender instrument and exploration of the bladder should, therefore, be shorter and less curved. By introduction into the vagina, the stone can be tilted forward, the examination.

OPERATIONS.—The treatment of Stone in the Bladder. Various *Operative* procedures appropriate for the removal of stone have been devised, two of which are established: (1) Lithotomy, or the extraction of stone by a cutting operation—removal of stone mechanically by instruments, without the use of the knife—as by Lithotrity or crushing in the bladder and removal of the debris through the urethra; or sometimes by simple extraction; (2) Solution of stone, by chemical agents or by the agency of electricity—"electrolysis."

Lithotomy, or the operation of cutting for Stone, has been performed in various ways; both as regards the position and the method of its performance. There are three principal operations of lithotomy: in the perineum or hypogastric region, and through the rectum; the three principal operations of lithotomy—Perineal lithotomy, High operation, and the Recto-vesical operation. The

and the urinary secretion having been corrected as far as possible by alkalies or acids, according to the character of the calculus, the bowels should be well relieved by mild purgatives, and the rectum especially must be emptied by an *enema* of castor oil and soap-suds on the morning of the operation. On no account should the operation be performed until the *enema* has come away, the loaded state of the bowel much increasing the liability of wounding this part.

Lateral Operation.—Four assistants at least are required for the performance of this operation; one to administer chloroform, one on each side of the patient to fix the perinæum in the proper position as presently described, and a fourth to take charge of the staff. A fifth assistant might be convenient to hand instruments, unless they are placed within easy reach of the operator, when sitting down.

The operation consists in cutting on a staff into the bladder—by a preliminary superficial, perineal incision to reach the instrument, followed by a deep or prostatic incision in the groove of the staff to enter the bladder; seizure, and extraction of the stone. Thence the *instruments* essentially requisite are simply three: a staff, a knife, and forceps.

The patient is placed recumbent on the table, and chloroform administered. Then the bladder, having been previously emptied of urine, should be *injected with tepid water* to the amount of about *four to six* ounces,—supposing the patient to be an *adult*,—in order to steady the bladder and expose the stone to the grasp of the forceps. But over-distension of the bladder will render the operation more difficult, by causing the organ to recede; and the prostatic urethra thus being elongated, the perinæum becomes deepened. *Sounding* should now be performed, immediately before the operation is commenced—when the patient's bladder is in position. This may be done with an ordinary sound; but it is preferable to at once introduce the *staff* of sufficient size to occupy the urethra, and, using it as a sound, the stone must be distinctly felt and its situation ascertained. This is an *imperative rule* in regard to lithotomy. If the stone cannot be felt at the time of operating, the operation should be unhesitatingly postponed; if it can be felt, the operation is proceeded with.

The patient is brought to the end of the table, so that his buttocks resting on the edge shall project a little beyond it; the legs are to be drawn up and the hands and ankles firmly bound together with the lithotomy bands, as thus,—either hand being placed on the outer side of the ankle and made to grasp the foot, both are securely joined in this position by a figure-of-eight application of the band. Or, the couplet leathern straps used by most operators is a more simple and equally secure contrivance. Then, the *side assistants*, taking each a foot in his hand on the inner aspect of the foot, and placing the patient's knee in his axilla, the limbs are drawn sufficiently apart to fully expose and throw out the perinæum, at the same time observing that it inclines to neither one side nor the other, but is fixed perpendicularly, or horizontally to the table, and maintained in this position throughout the operation.

The *staff* is now given in charge of an assistant, standing on the patient's left, with the injunction to hold it firmly—the thumb supporting the flat surface of the handle—in the perpendicular direction, and the curve of the instrument being *hooked up* under the symphysis pubis (Fig.

130). (Some Surgeons prefer that the convexity of the staff should be made to bulge slightly forward in the perineum; others that it should be turned somewhat towards the left of the perineum; while some prefer that it should be depressed and held in contact with the stone.) The assistant holds the staff between the thumb and fingers of his right hand; the left hand is used to raise the scrotum from the raphé running down to the rectum. Thus, then, the space between the urethra and the rectum is exposed as much as possible, so that the one can be more readily approached without the risk of wounding the other.

The Surgeon seating himself on a stool in front of the perineum, the exposed, he shaves the integument on the left side, and introduces his finger into the rectum to know for certain that the bowel is empty and

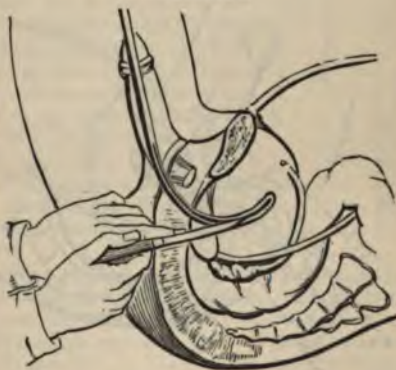
FIG. 130.



to induce its contraction; whereby any remaining feculent matter will be expelled, and the contracted state of the bowel diminishes the risk of being wounded during the deeper incision. At the same time, the curve of the staff should be felt to pass straight through the prostatic urethra and thus to enter the bladder. Then, with his left hand *thumbing* the tuberosity of the ischium and the ramus on the left side, he feels also with the point of the forefinger, the sort of depression below the bulb of the urethra, in the middle line or raphé, which lies over the curve of the staff; a point about an inch and a half in front of the anus, rather less than higher, and corresponding to a part of the instrument which a thin perineum can often be plainly felt. (1.) The landmarks of the incision having thus been clearly defined, the Surgeon rests his left hand on the right half of the perineum, so as to make the skin on the left side

slightly tense; and indicating with the forefinger the above *spot*, he plants the lithotomy-knife perpendicularly, to the *left* of the *raphé* by about *one-third* of an *inch*, and carrying the blade in a straight line *obliquely downwards* and *outwards*, midway between the anus and tuberosity of the ischium, or somewhat nearer to the latter, terminates the incision at a point *just below* the *anus*. A *free* but superficial *perineal* incision is thus made. The *length* of this incision will be from three inches to three and a half, in the adult; its extent varying according to the size of the perinæum, and apparent size of the stone. The skin, superficial fascia, and fat are divided; but the *depth* of the incision, varying according to the perineal obesity, is above rather less than an inch, while below the knife is drawn out slopingly from the ischio-rectal fossa. The upper half of this incision, above the anus, leads to the staff; the lower half, by the side of the anus and below it, facilitates the extraction of the stone. (2.) The point of the forefinger of the left hand is now *drawn firmly*, from the upper angle, along the bottom of the wound, *between* the left erector penis and ejaculator urinæ muscle overlying the bulb of the urethra, so as to separate these parts; then, using the finger to *protect* the *rectum*, by pressing it somewhat downwards and to the right, any further resisting structures are divided by a slight touch or two with the knife. The finger is then directed *upwards from the rectum*, as a guide to the staff; the groove of the staff is felt just in front of the prostate, in the membranous portion of the urethra, and as covered therefore with this membranous structure stretching across the groove. By a little compression at this spot, the nail of the finger is lodged fairly in the groove; and then the point of the knife, with the cutting edge downwards, is *slid* along the finger over the nail, and, penetrating the membranous urethra, is at once inserted into the groove of the staff, and felt to touch the metal, at the commencement of the *deep* or *prostatic* incision (Fig.

FIG. 131.



130). (3.) The knife is now pushed *firmly* along the groove of the staff, through the prostatic portion of the urethra and the prostate, with a slight inclination of the blade *downwards* and *outwards* (Fig. 131); thereby incising or notching the prostate *laterally*, in the same direction as the external or superficial incision; while the point of the blade, by slightly *depressing* the handle to a *very limited angle* with the staff, follows the curve of the staff, until the bladder is entered. If the knife, directed sideways, runs firmly in the groove of the staff, so as not to slip out to the left, the blade cannot go wrong, and the incision must be right. The bladder is known to be entered by resistance ceasing, and

perhaps a gush of water taking place. A *button-pointed* lithotomy-knife may, perhaps, be used more safely, as it locks into, and has a more secure hold in, the groove of the staff. It is introduced into the groove of the staff, after a small incision, to the extent of three or four lines, has been made into the membranous urethra by the sharp-pointed knife, in the perineal incision. I have never yet thought it necessary to use this instrument. In withdrawing the knife through the prostate, it should pass over the finger, in the same direction as in introducing it, and still in the groove of the staff, so as not to enlarge the incision. Thus the deep or prostatic incision is essentially limited in its extent through the prostate; not exceeding twice the width of the blade of the knife, and certainly not passing beyond the base of the gland, where its capsule prevents infiltration of urine into the cellular texture of the pelvic cavity behind the prostate. On withdrawing the knife, the left forefinger is pushed forward after it through the prostatic incision into the bladder; and, if this manœuvre be executed adroitly, the introduction of the one follows the exit of the other,—the finger replacing the knife *before* the water escapes in any gush from the bladder. (4.) The finger, fitting into the incision, is made to enlarge the wound by a sort of twisting, or tunneling motion; whereby the opening is dilated and the prostate somewhat split, as with a blunt gorget, instead of having been cut freely by the

FIG. 132.



knife. As the finger proceeds, at the same time the stone is felt for. This double duty of the finger, as a *dilator* and a *searcher*, may be conveniently performed while the Surgeon is taking the forceps with his other hand from an assistant, or from a basin of warm water at his side. Having entered the bladder, and found the stone, the assistant is directed to withdraw the staff.

(5.) Then the Surgeon introducing the closed blades of the forceps over the finger, he slides them into the bladder, withdrawing the finger at the same time, and opening the

blades of the instrument; a gush of water now takes place,—if not previously, in making the prostatic incision,—and thus the stone may sometimes be washed into the grasp of the forceps; or, on somewhat *dipping* the forceps, usually with a sort of sweep from left to right across the fundus of the bladder, the stone is at once caught and seized, whereby the instrument feels suddenly locked. Failing, in either of these ways, to catch the stone, it should be gently sought for, and touched with the forceps. It may then be seized by one or two manœuvres, as in lithotomy; either by depressing the fundus of the bladder with one blade, and giving a slight shake, when the stone will fall into the grasp of the instrument; or, by

sliding the blades along the side of the stone, then opening them, and turning the opened blades over to that body, it will be seized almost with certainty. The size of the stone may be estimated by observing how far the handles are separated. If it seem to be seized in its long diameter, and too large for extraction, the stone may be shifted by a jerk of the forceps, or disengaged and resealed, so as to be extracted without lacerating or bruising the neck of the bladder.

(6.) *Extraction* should be performed slowly, and by working the instrument gently *backwards* and *forwards* to gradually dilate the prostatic aperture; *bearing downwards* also in the direction of the axis of the pelvis (Fig. 132), in order that the widest part of the arch of the pubes may be available for the extraction, and the lower part of the perineal incision which facilitates this concluding part of the operation. The forceps lie in the axis of the pelvis, and are withdrawn in the same direction as obstetric forceps. And as, *in* the act of withdrawing the knife through the prostatic incision, the finger at once followed it forward; so also, *in* withdrawing the forceps, the finger is again made to follow this instrument, that thus the entrance to the bladder shall never be lost—an injunction the more imperative when the staff, as a guide, has been withdrawn. If the stone slips from the forceps, after having been withdrawn through the prostate, it cannot be resealed under the *pubic arch*, or without disturbing the cellular connections of the bladder and rectum; the finger should be passed into the bowel, to fix the stone from behind, and then, with the *scoop* (Fig. 133), it may be drawn or tilted out of the wound. After removing the stone, if it has a faceted shape,—as from attrition—there will probably be another; in every case, however, the *finger* should be *reintroduced* into the bladder to search for any other stone which may be present; or the *searcher* can be used for this purpose to reach parts of the bladder not readily accessible to the finger, as in front above the pubes. No second stone having been discovered, the operation is completed.

FIG. 133.



Parts cut, and Parts to be avoided, in Lateral Lithotomy.

—If the operation be conducted on the principles laid down, the question of the “parts” concerned is more an anatomical investigation than a surgical consideration—more a Student’s question than of practical consequence. The parts necessarily *divided*, in their order from without inwards, are—the skin, superficial fascia, and fat, with the inferior hæmorrhoidal vessels and nerves passing across the ischio-rectal fossa; the transverse perineal muscle and artery, with probably the superficial perineal artery and nerves; the base of the triangular ligament and the deep transverse urethral muscle; the membranous urethra and constrictor muscle; the prostatic urethra, and the prostate to a limited extent in its left lateral lobe, including the “ligamentous ring or band” around the neck of the bladder, but not the capsular boundary formed by the reflexion of the recto-vesical portion of the pelvic fascia. External to the capsule, some of the anterior fibres of the levator ani muscle will be divided, and within the capsule, a plexus of rather large-sized veins must be severed—in the *prostatic incision*.

The parts to be avoided in the operation are in anatomical works thus enumerated—the rectum; the internal pelvic artery, where it courses beneath and over of the neck of the probe; the bulb of the urethra; and the artery of the bulb, which normally passes inwards transversely about half an inch above the base of the triangular ligament, between it and the other or deep layer of the perineal fascia. 1. The rectum will be avoided by having the staff well hooked up, and by commencing the incision sufficiently high up—rather more than an inch above the anus, and fairly outside the nape; then by protecting the bowel with the finger—especially in commencing the deep or prostatic incision, and later holding the knife parallel with the bowel—particularly in an old person, whose rectum is commonly dilated into a pouch just above the anus, sometimes even wrapping around the prostate from side to side. The prevention of an opening the bowel should also be observed. 2. The arterial vessels mentioned are less readily wounded; but, when presenting anomalies, they may be unavoidable. The *pelvic* artery will be avoided by not turning the knife too much outwards in making the deep incision. Occasionally, this artery is securely lodged under cover of the *bulb* itself; but occasionally it descends over the inferior surface of the bladder and across the prostate to reach the penis. Or, the *accessory* pelvic, as an occasional substitute for the pelvic, when defective, lies on the posterior edge of the prostate; it may then be avoided by not extending the prostatic incision backwards to the base of the gland. The artery of the bulb, a serious source of hemorrhage, may perhaps be avoided by not cutting too freely upwards towards the groove of the staff; but an irregular course of the vessel, lower down than usual, cannot be foreseen or avoided by any plan of incision. Sometimes also, as arising from the *obturator* artery, or as a branch from the artery of the bulb on the opposite side, neither of these anomalies can possibly be anticipated. 3. Lastly, the bulb of the urethra, a source of venous hemorrhage, may be avoided by directing the point of the knife *obliquely upwards beneath its projection*, in the act of penetrating the membranous urethra. The bulb is most liable to be wounded by opening the membranous urethra anteriorly, instead of more deeply, just in front of the prostate. The venous plexuses, within the capsule of the prostate, are sometimes much enlarged, especially in old men, and become a source of unavoidable hemorrhage.

The Lateral Operation in Children.—Lateral lithotomy is performed in the same way in Children as in Adults; but the anatomical condition of the parts under the age of puberty, and especially in childhood, affects the performance of this operation. The anatomical peculiarities alluded to are chiefly four: looseness of the perineal cellular texture in the men-strual space; the small size, and thinness, of the membranous urethra; the rudimentary small size of the prostate; and the position of the bladder—it being situated higher up, or more in the abdomen than in the pelvis. These conditions severally affect the operation in its first part—that of entering the bladder; extraction of the stone is not attended with any special difficulty.

1. The superficial perineal incision having been made correctly, the loose cellular texture easily yields and gives way under the finger, forming a distinct, smooth-walled cavity or false bladder, in the recto-vesical space; which resembles the interior of the bladder. A very little

groping with the finger, in the wrong direction—*downwards*—will form this deceptive cavity; into which the finger readily enters as if into the bladder. Perhaps also the membranous urethra has been penetrated, whereby the *urine dribbles away* and the bladder gradually collapses; both circumstances apparently confirming the belief that the finger is really in that cavity. Indeed, the latter condition affords more room for the easy enlargement of the false bladder. In this anxious and perilous moment, two points of distinction should be remembered: this false bladder presents *no neck* through which the finger should pass to gain admission, nor can the *bare* grooved staff be felt along the back of the finger when introduced into the cavity. Besides both these negative features of distinction, *above* this cavity, near the symphysis pubis, lies the staff leading to the bladder; and which can be plainly felt on directing the finger from the scene of mischief obliquely *upwards* to that spot. Hence the practical inferences are these: in approaching the staff, to avoid making anatomy by a too free use of the finger as a guide; and to direct both it and the knife upwards to the more highly situated staff, instead of heedlessly slipping into and working in the interval between the bladder and rectum. A precaution before operating should also be observed—that of sufficiently *distending* the bladder with water to *lower* its position in the pelvis *and to steady its neck*. The same kind of misadventure may occur between the *neck* of the bladder and the *pubes*, by misuse and misdirection of the finger *upwards*. It need scarcely be added that, in either such case, the little patient remains unrelieved, and dies with the stone in the bladder. Yet this calamity has happened to some of the most skilful and experienced lithotomists—past and present.

2. Again, in endeavouring to hit the membranous urethra and lodge the point of the knife in the groove of the staff, the urethra being of *small size*, it may be so *cut* about as to be nearly severed from the prostate. Or, if the point of the finger be not insinuated well into the opening, or if any undue force be used in passing it into the bladder, the *thin* membranous urethra may be *torn across*, and the neck of the bladder driven backwards on, or off, the staff,—an accident more likely to happen when the urethra has been nearly severed.

Thus then, in opening the urethra, as in approaching it, *fiddling* with the knife must be avoided; and in both procedures, any *forcible* use of the finger will also be mischievous.

3. The *rudimentary size* of the prostate, and (4) the *high position* of the bladder, will both necessitate a *more upward* direction of the point of the knife, in making the prostatic incision. And it should be remembered that this incision must necessarily almost always, if not invariably, extend through the whole of the small prostate, in its left lobe; yet without any evil consequence.

In entering the neck of the bladder, the feeling is that of passing over a small ring; without riding over the sort of chestnut-like projection upwards of the prostate, and which may be like a half-orange in an elderly man. The *neck* is the *lowest* portion of the bladder—lower than the inferior fundus, in a child.

When the *prostate* has been *detached* from the *membranous urethra*, and the neck of the bladder recedes before the point of the finger, all

the presence of mind and dexterity of the Surgeon will be required at this trying moment of peril and anxiety. Much will depend on whether the *staff* still remains in the bladder, as a *guide*. If so, the forefinger should be passed more cautiously and gently along the groove, and a slight hooking movement made at the neck, so as to draw down this part. It may then be notched, by insinuating the knife along the finger, which can thus be fairly entered. If the *staff* be out of the bladder, or has been withdrawn, the position of both patient and Surgeon is most critical. It may be possible to reintroduce the instrument, and then proceed as just directed. Failing to accomplish the first step, the attempt to hook down the neck of the bladder should never be resorted to—in the absence of a *guide*. The finger or any searching instrument will only pass deeper and deeper with increasing damage, and inevitable death result. Moral courage is here the better part of valour, and any further operative interference should be resolutely abandoned. The urethra may heal, restoring the continuity of the canal, when the operation can be repeated and brought to a happy issue.

Difficulties during Lateral Lithotomy.—The *Difficulties* which may occur in the performance of the lateral operation relate either: (1) to entering the bladder; or (2) to seizing and extracting the stone. The first occur more especially in operating on *children*, and have been already described; the second kind of difficulties are met with more commonly in *adults*. In *children*, two difficulties are very liable to happen in endeavouring to enter the bladder: the formation of a false bladder in the recto-vesical space, and the incised or torn detachment of the neck of the bladder from the membranous urethra. In *adults*, the first of these difficulties has occurred, as the result of prolonged boring with the finger in the cellular interval between the bladder and rectum.

(1.) A DEEP PERINEUM presents obstacles to entering the bladder. The depth of perineum may be due to *fat* in a corpulent person, or to an *enlarged prostate* in an elderly person. Both conditions not unfrequently co-exist, coupled also with an indurated state of the prostate. A forefinger of average length can perhaps scarcely reach the bladder, if at all; and the prostatic condition of enlargement and rigidity obstructs the introduction of the finger. The *Wesst* gorget, formerly in ordinary use, is here very appropriate; as affording the means of dilating the incomplete incision in the enlarged and indurated gland, and of gaining access to the bladder beyond reach of the finger.

(2.) SEIZURE and EXTRACTION of the stone may present difficulties dependent on several conditions:—depth of the perineum, particularly when due to an Enlarged Prostate; an Encysted, or an adherent state of the stone; the Position, Size, and Shape of the Stone; Fracture of the stone; Bladder-difficulties—in the form of enveloping folds of mucous membrane, or hour-glass contraction; Rickety deformity of the pelvis, in its antero-posterior diameter, or by narrowing of the pelvic arch. These various conditions interfere with the use of the forceps, either in introducing the instrument into the bladder, or in seizing or in extracting the stone.

1. *Enlargement of the Prostate*, which places the bladder beyond reach of the finger, renders the introduction of the forceps difficult, and the stone worn so, owing to the liability of its falling into the

depression behind the prostate, and thus escaping the sweep of the forceps; but the latter difficulty may be overcome by using *long curved forceps*, at the same time endeavouring to raise the stone by passing the finger into the rectum, if the fundus of the bladder can be reached behind the enlarged prostate. In *extracting* the stone through an enlarged prostate, some difficulty may be experienced; and rather than bruise or lacerate the parts, it would be proper to *incise* the opposite side of the prostate towards the tuberosity of the right ischium, or better—at a right angle, thus forming a bilateral section of this body, without making any additional perineal incision.

2. *Encysted Calculus* is not very common. The orifice of the sacculus may be *nicked* with a probe-pointed bistoury, and the calculus turned out with the finger or *scoop*. But this procedure is extremely hazardous, since the bladder might easily be cut through into the peritoneal cavity. When, therefore, the calculus cannot be dislodged, the operation should be abandoned.

3. *Position of the Stone*.—Two parts of the bladder, in either of which the calculus may be situated, offer considerable difficulty to *seizure* of the stone. When lodged in a depression *behind* an *enlarged prostate*, the stone must be brought up by tilting the bladder with the finger introduced into the rectum, and then using a *long curved* pair of forceps or a curved scoop. When situated *above* the *pubes* anteriorly, towards the upper fundus of the bladder, the stone must be lowered by *compressing the abdomen*, and then seized with a *curved forceps* or the curved scoop. Raising the pelvis will sometimes enable the forceps to grasp the stone.

4. *Shape and Size of the Stone*.—The shape of the stone may offer some difficulty to its seizure with the forceps. A round irregular stone, as a mulberry calculus, is grasped less readily than a flattened, smooth stone, which lies easily within the blades of the forceps. Irregular-shaped phosphatic calculi present the greatest difficulty.

Both the shape and large size of the stone may offer considerable obstacles to its *extraction*. Three resources are practicable:—(1) section of the right lobe of the prostate, forming the bilateral section of this body; (2) crushing, splitting, or drilling and breaking up the stone in the bladder—by means of strong lithotomy-forceps, cutting forceps, or lithotrites,—thus performing perineal lithotrity; (3) the supra-pubic operation of lithotomy. Of these procedures, section of the prostate is most practicable and the safest. The forceps still grasping the stone is held fast by an assistant, and the *right lobe* of the *prostate* is then *incised* towards the right tuber ischii, by passing the knife or a blunt-pointed bistoury along the blade of the instrument as a director.

5. *Fracture of the Stone* is apt to happen when the calculus is brittle, or soft; breaking into several sharp fragments, or squashing into a soft mortar-like mass. It occurs mostly to *phosphatic* calculi. This breaking down of the stone results usually from too firm a grasp with the forceps, either lest the stone should slip away, or by pulling too high up and coming in contact with the pubic arch, or in consequence of the pressure requisite in extracting a large-sized stone. The fracture generally leaves a central stone in the blades of the forceps, which should be extracted, and the detached fragments removed by the repeated introduction of this

ligature or torsion of any distinctly bleeding artery that may be accessible, or by *pressure*. The artery of the bulb is the principal source of serious, or even fatal hæmorrhage; and so also would be the internal pudic, as it can scarcely retract within the obturator fascia overlying it; but this vessel is well protected under cover of the ramus of the ischium. (b) *Oozing hæmorrhage*, of a persistent character, may be effectually arrested by *injecting ice-cold water*, or by *plugging* the perineal wound. This is precisely the condition in which Liston's gum-elastic tube may be used with advantage, while free vent also will thus be given to the urine. The track of the wound is plugged with dossils of lint around the tube; or more conveniently, by pieces of sponge introduced into a conical bag of oiled silk attached to the tube. Liston's tube is kept free of coagula by the occasional introduction of an oiled feather. (c) *Venous hæmorrhage*, proceeding chiefly from the prostatic plexus of veins, may be arrested in like manner. (d) *Retrocedent hæmorrhage*, the blood, arterial or venous, passing back into the bladder, sometimes occurs and to an alarming extent. Bloody urine escapes by the wound, but the bladder becomes distended; there is dulness on percussion above the pubes, and faintness ensues. *Injections of cold water* should be used to wash out the bladder; and ligature or plugging applied, according to the nature and source of the hæmorrhage.

(3.) **WOUND OF THE BULB** is an accident of no serious consequence. But the accident has given rise to *phlebitis* and *pyæmia*.

(4.) **MISSING THE URETHRA, AND ENTERING THE BLADDER BEYOND THE PROSTATE**, allows of infiltration of urine into the pelvic cellular tissue. Diffuse inflammation and death will almost necessarily follow. Yet this fatal accident has occurred, once in a way, to the most skilled lithotomists. To avoid it, the nail of the left forefinger should be lodged fairly in the groove of the staff, before planting the point of the knife over the nail.

In **CHILDREN**, the accidents specially incident to lateral lithotomy have been fully considered in describing the operation as performed before puberty or at an earlier period of life.

After-Treatment.—When no accident has occurred during the operation, the treatment after lateral lithotomy is simple. The patient is placed on his back in bed, with his legs apart and the knees somewhat raised on pillows. The urine will thus drain away through the wound, as it is secreted, preventing the chance of urinary infiltration. The bowels having been well emptied before operation, need not be relieved for four or five days,—in order not to disturb the bladder. Then a mild oleaginous enema may suffice, just to clear the rectum.

(1.) **PELVIC CELLULITIS** is the only dread the Surgeon may have to apprehend after the operation; when the stone is of large size, so as to cause bruising or laceration of the neck of the bladder, from forcible extraction; or urinary infiltration into the peri-vesical cellular texture, from a prostatic incision beyond the boundary of the capsule. The *symptoms* supervene in *twenty-four to forty-eight hours*. The patient complains of an aching weight and bearing down, or perhaps a smarting pain, at the *neck* of the bladder; and *pain* is elicited on *pressure above the pubes*, especially in the left groin, and by tilting the prostate with the finger in the rectum. This vesical pain is constant—not intermittent, like spasm.

Rigors are followed by a dry, hot skin, a rapid, feeble, intermittent, or fluttering pulse, and a dry brown tongue; then, a cold, clammy sweat breaks out; the countenance betokens great anxiety, hiccupy respiration adds to the distress, the abdomen becomes distended and tympanitic, the perineal wound dry and gangrenous-smelling, while utter exhaustion closes the scene, in from three to five days. Thus the patient dies in, or under, a week after the operation. *Post-mortem* examination discloses an inflamed, sloughy state of the cellular texture around the neck of the bladder, with perhaps, apparently, some infiltration of urine. The adjoining cul-de-sac of peritoneum may be involved, by extension of the cellulitis backwards. The treatment should be tonic and sedative—to support the patient, by beef-tea, brandy-and-egg mixture, quinine, and opium; but recovery is almost hopeless. Sir B. Brodie, considering the analogy between peri-vesical urinary infiltration and scrotal extravasation of urine, suggested an operation, which he performed on one occasion, and with a successful result. Having introduced his left forefinger into the rectum, he passed a probe-pointed curved bistoury up the perineal wound to the left side of the neck of the bladder. Then, feeling the point through the bowel, he made an incision downwards, dividing the lower part of the rectum and sphincter; thus laying open the perineal wound and bowel into one track, for the free discharge of urine and slough. Little bleeding followed. The relief was instantaneous. It is worthy of note, that in about a month, the rectum began to contract, and shortly the urine flowed by the urethra.

(2.) VESICAL SPASM has occurred in my experience; the symptoms being a plunging sensation at the neck of the bladder, with acute pain at the end of the penis. The attack recurs at intervals, and is unaccompanied with any pain on pressure above the pubes, or when the bladder or prostate is tilted with the finger in the rectum. This painful spasmodic affection may thus be distinguished from the uninterrupted pain of pelvic cellulitis around the neck of the bladder—a much more perilous event. The spasm arises from a tympanitic state of the abdomen forcing the bladder downwards. Escape of flatus from the bowels has soon afforded great relief. But the same suffering may be produced by clotted blood in the bladder, impinging on the neck and prostatic urethra. Then, by passing an elastic catheter up the wound, or through the urethra, or in both ways to reach and displace the clot, the Surgeon may thus relieve the symptoms.

(3.) ERYSIPELUS OF URETHRA sometimes occurs, and must be instantly relieved by passing a gum-elastic catheter or the finger up the wound to the neck of the bladder. Warm fomentations and opiates will then allay pain and irritation. About the fourth or fifth day, the urine may suddenly cease to escape through the wound, and be discharged through the urethra;—the patient “wets,” as nurses are accustomed to understand it. This, however, seems due to a temporary turgescence in the wound, resulting from inflammatory swelling which occludes the outlet; subsiding in a day or two, the urine again escapes by the wound. The same temporary discharge of urine through the natural passage may happen at an earlier period,—within twenty-four hours after operation. It is not at all a favourable sign. Urine having again returned through the wound, the quantity gradually diminishes during granulation and contraction; &

portion passes permanently by the urethra in a week or ten days, and the wound closes about the end of a fortnight to three weeks. The urine itself, at first bloody, gradually assumes a brownish colour, as it becomes clearer, with the closure of the wound. The perineal wound is usually healed *securely*, in from thirty to forty days.

Causes of Death, and Results, after Lateral Lithotomy.—The principal causes of death are: (1) Old Age; (2) Large Calculus and Pelvic Cellulitis; (3) Disease of the Kidneys; (4) Hæmorrhage; (5) Shock; (6) Cystitis; (7) Peritonitis; (8) Pyæmia. To which may be added, Erysipelas and Tetanus, as accidental and quite exceptional causes. The mortality at all ages rates at 1 in 7, 8, or 9.

Median Lithotomy.—The Median operation of lithotomy is so named, because the incision is made in the *middle line* of the perinæum. But this operation comprises *two methods* of procedure in relation to the prostate: a vertical section of the membranous urethra alone, and then dilatation of the prostate with the neck of the bladder; or a vertical section of the prostate, avoiding the membranous urethra. Formerly the one was called also the "Marian operation," as having been advocated by Sanctus Marianus; and the "operation of the apparatus major," from the number of instruments employed in performing it.

ALLARTON'S OPERATION.—The Marian operation had long fallen into disuse, but of late years it has been revived and slightly modified by Mr. Allarton; while in America, it was first brought into notice by Markol, and afterwards advocated by Little and Walter.

The operation is thus performed: the *curved staff*, having a *central groove*, is held by an assistant, firmly, perpendicularly, and hooked up against the pubes; the *forefinger* of the left hand is introduced into the rectum, so that its point shall steady the staff in the prostate; a straight, sharp-pointed knife is entered into the perinæum, in the *middle line*, about *half an inch above the anus*, and carried on steadily till it strikes the groove of the staff at the *membranous urethra*—a depth of about one inch and a half; the knife is moved along the groove towards the prostate for a few lines deeper, and then withdrawn, at the same time *cutting upwards* an *external incision* of three-quarters to an inch and a half, according to the presumed size of the stone. A long ball-pointed probe is slid along the groove of the staff into the bladder, and the latter instrument then withdrawn. But the left *forefinger* is passed along the probe into the bladder, and used to *dilate the prostate and neck*, serving also as a guide to the forceps. When the stone is free, it comes at once into contact with the finger, and, if of moderate size, escapes readily into the wound on withdrawing the finger, or aided by the scoop.

The *advantages* claimed for the Median, over the Lateral operation, are—that the incision being strictly in the median line, no vessels are divided, and the integrity of the bladder is preserved. But, the risk of wounding the bulb, or the rectum, must be reckoned as *disadvantages* incident to median lithotomy.

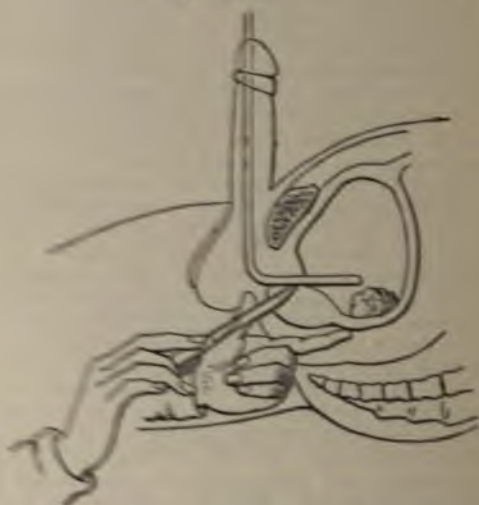
This operation is most suitable for *small stones*, and where lithotripsy is inadmissible—owing chiefly to irritability of the urinary organs, with perhaps a hard stone. Median lithotomy may be resorted to *after lithotripsy*, in cases where the bladder and kidneys cannot tolerate the repeated use of the lithotrite, or irritation from the continued presence of frag-

ment. But *rapid* Lithotomy or Lithotomy, with complete evacuation of the fragments—as a primary operation, would, however, be preferable to median lithotomy—as a supplement to lithotomy, *excepting* where the irritability of the urinary organs is too extreme for even the rapid operation, and the stone is too hard for crushing.

The Results of Median, as compared with those of Lateral, Lithotomy have been decidedly unfavourable; a difference owing doubtless to the fact that in Median Lithotomy, without section of the prostate, this gland and the neck of the bladder are bruised and lacerated by dilatation with the "bougie."

RECTANGULAR STAFF OPERATION.—Dr. Buchanan, of Glasgow, introduced this procedure, which is a modification of the Median operation. A rectangular staff is used, with the short branch grooved at its side. This instrument having been passed into the bladder, the angle is made

FIG. 134.



to correspond in situation with the front of the prostate, the lower or grooved branch going parallel to the rectum. The left forefinger is passed into the rectum, and a long straight knife, held with the blade horizontal and the edge turned to the left, is made to enter the perineum opposite the angle of the staff, and passed straight into and along the groove into the bladder (Fig. 134). The membranous urethra is thus left untouched. In withdrawing the knife, a lateral section of the prostate is made in its left lobe; and at the same time, an external incision downwards and outwards, round the upper and left side of the anus, to about an inch and a quarter in extent.

Advantages.—Certain features in this method of Median Lithotomy

are clearly in its favour:—the membranous portion of the urethra is avoided, and all *blood-vessels* are out of the way; with the additional advantage, that the *bulb* and the *rectum* are both less liable to be wounded; and there is no *bruising* of the *prostate*—less risk of deep-seated infiltration of urine.

Equally eligible with Allarton's operation, for *small stones*, Lithotrixy will include all such cases,—when not inadmissible, in dealing with a very irritable bladder, and perhaps a very hard, oxalate of lime calculus.

Supra-pubic, Hypogastric, or High Operation.—The large size of the calculus, or the state of the *perinæum*, especially with regard to the pelvic outlet, may render Perineal Lithotomy, in any form, impracticable. Under these circumstances, or when Lithotrixy is ineligible, recourse may be had to Supra-pubic lithotomy. In *children*, and persons below twenty years of age, the bladder stands high above the pubes, and presents a portion uncovered by peritoneum, which is freely accessible; under eight years, the peritoneal reflexion from the bladder does not generally reach lower than an inch and a half to two inches from the navel. In *old* persons, especially when emaciated, the bladder lies deep in the pelvis, behind the symphysis pubis, and would be difficult to reach, especially in a corpulent person. Chronic cystitis, resulting in a thickened state of the bladder, will also render the operation difficult.

OPERATION.—In order to perform supra-pubic lithotomy, the bladder should be washed out with warm boracic-acid solution, to remove any collection of muco-purulent secretion, which might otherwise poison the supra-pubic wound. Then, the bladder must be made to rise above the pubes; and this may be accomplished either by *full distension* of the bladder with water, or by means of a catheter or other instrument introduced through the urethra into the bladder, so that its point shall project above the pubes. Both means are adopted to insure a presenting part or point of the bladder in that situation. But, to Petersen, of Kiel, is due the credit of having first adopted the expedient of dilating the *rectum*, by means of a pear-shaped bag, distended with water; the bladder, itself distended, being thus raised above the pubes, until the outline of the organ can be traced; and it is also more effectually steadied in that position during operation, by the support of the rectum.

The operation consists in making a vertical incision in the *middle line*, above the pubes, carried upwards to about three inches in length; the *linea alba* is exposed, and the incision carried through the muscular wall of the abdomen and fascia transversalis; the projecting part of the bladder—being recognized by its greyish muscular appearance, uncovered by peritoneum, is sought just above the symphysis, and opened on the point of the instrument within its cavity; this incision being prolonged *downwards* towards the neck of the bladder with a probe-pointed bistoury, sufficiently to admit the finger. The point for opening may be steadied with a tenaculum, on either side. The forceps is then passed in, and the stone extracted. Accidental *fracture* of the calculus will present a difficulty of more consequence than when it occurs in the lateral operation; for the bladder cannot readily be washed out, and, a fragment remaining, the recurrence of stone is inevitable. The performance of this operation is much more difficult than it would appear to be, owing to the depth of the body of the bladder in the pelvis.

by pillows, or lowered, according to the inclination of the pelvis, and the legs separated and somewhat flexed. Chloroform or other anæsthetic having been administered; the bladder is first *emptied*, and then injected with *tepid water* until it contains from about *four* to five ounces of fluid, in order that its cavity shall be sufficiently distended to remove the mucous membrane from the blades of the lithotrite in seizing the stone, with even the best bevelled instrument, and to make room for crushing without injuring the bladder by splintering. Then the Surgeon, standing on the right side of the patient, as the most convenient position, introduces the warmed and oiled lithotrite cautiously along the urethra. The abrupt curve of this instrument, unlike the arched curve of the catheter, and resembling that of a sound, must be remembered as soon as the instrument reaches the curved portion of the urethra. By *depressing the handle slowly* down to a *right angle* with the perinæum, the end of the lithotrite is brought into the direction of the canal under the pubic arch, and thence passed gently into the bladder. A *slight rotatory movement* with the instrument will always indicate when it has entered the bladder. In connection with *enlargement of the prostate*, the increased length, and upward curve of the prostatic urethra, should be duly observed in passing the lithotrite.

(1.) *Seizure of the Stone.*—The *situation* of the stone is often ascertained in *passing* the lithotrite; then, the blades are *inclined* slightly *away* from the side on which the stone lies,—not to move it from its position, carrying the instrument backwards also towards the posterior wall of the bladder, while the *male blade* is slowly withdrawn—not to impinge on the neck of the bladder. By *turning the opened lithotrite* over towards the stone, and slowly closing the blades, the stone will almost certainly be seized. The blades are felt to be suddenly locked by the stone between them; and the male blade not sliding to the end of the female blade, the graduated portion adjoining the screw will show the size of the stone in the diameter that the calculus happens to have been caught. Most frequently the stone will be caught on the *right side of the floor* of the bladder. If no stone be felt on entering the bladder, its cavity is *explored*, by a *slow twirling revolution* of the instrument on its own axis, between the thumb and finger, without changing its central direction; and at the same time, a gently sliding motion of the male branch backwards and forwards to the extent of half or three-quarters of an inch—thus *gently raking* or *traversing* the floor of the bladder on either side successively. Sometimes, by slightly depressing the *fundus* of the bladder with the instrument, the stone will fall into the open blades of the lithotrite.

If the *prostate be enlarged*, and the stone possibly lodged in a *receptacle* behind it, or if the stone be small or a fragment only, the blades may be reversed or *turned downwards*, and the *handle depressed* (Fig. 135); then, by opening and closing in the middle, or with a rotatory inclination from side to side, the stone will often be found and secured with ease. To overcome the difficulty of prostatic enlargement, a *modified form* of lithotrite should be used; the curve of the instrument is made shorter and more abrupt, thus to mount over the upward projection of the prostate, especially if the middle lobe be enlarged, and the shaft is longer by two or three inches, on account of the elongation of the urethra; this twofold

construction of the instrument corresponding to that of the prostatic catheter. It will be desirable also to *elevate* the *pelvis*, so that the stone shall fall back towards the posterior wall of the bladder, and thus further aid the manipulation of seizure.

The old theory of performing this operation with scarcely touching the interior of the bladder, not to provoke subsequent cystitis, is now no

FIG. 135.*



longer tenable in the light of rapid lithotripsy, to evacuate all the fragments—as the cause of inflammation.

(2) *Crushing the Stone.*—When once firmly between the blades of the *lithotome*, the stone is to be crushed into fragments. It is raised to the *centre* of the bladder, so that the walls shall not be injured by the splintering of the stone. A little withdrawal and rotation of the instrument will

FIG. 136.



indicate, if necessary, that the mucous membrane is not caught with the stone. Holding the female branch firmly with the left hand, the handle of the screw is held between the thumb and fingers of the right hand, and the screw worked gradually from left to right, thus propelling the male branch forwards on the stone (Fig. 136). Fragment after fragment is then crushed in like manner, until all are thus reduced. In these crush-

* Showing the (screw) lithotrite, with male insliding blade below the female blade, in this position of the instrument.

ings, the instrument should not be moved much, as the fragments usually lie close together, having fallen as the stone broke to pieces, in first using the lithotrite.

In crushing the last fragment, the male branch must be sent home into the female branch, so that the blades come together. The object is known to be attained by observing that the entire length of the screw passes down the lithotrite. Then the instrument can be safely withdrawn.

3. An *evacuator*—15 or 16—having been introduced into the bladder, the aspirator, filled with water, is attached (Fig. 137). In working the apparatus, the evacuator should be kept with the aperture in the end, uppermost; the bulb of the aspirator is then to be compressed between the thumb and fingers of the right hand, the evacuator being held in position by the left hand; the fragments are thus driven up by a recoil-current from the fundus of the bladder; on relaxing the compression, the return-current produced by the aspirator will bring the fragments down towards the

FIG. 137.



aperture in the evacuator,—rather than drawing them from beneath. These movements of compressing and relaxing the bulb of the aspirator, alternately, are repeated until all the fragments are evacuated. As the fragments become fewer, a *slight dipping* of the evacuator will tend to increase the discharge.

4. The *impaction* of a fragment within the aperture, or canal, of the evacuator will be indicated by the india-rubber bulb of the aspirator suddenly ceasing to expand with the return-current. Then, a more forcible and jerking compression of the bulb may eject the fragment into the bladder, and thus clear the evacuator. Should the channel be absolutely blocked, it will be necessary to withdraw the instrument, and clear with a stylet.

5. In the course of operation on a *large stone*, it may be advantageous to crush and evacuate, alternately, two or three times; thus relieving the bladder of fragments produced by a first crushing, and making more room for working the lithotrite, when reintroduced.

(3.) *Encysted Calculus*—a stone lodged in a sacculus of the bladder—presents a specially difficult complication in lithotrity, no less than in lithotomy, as with regard to seizing the stone; but in the former operation, the after-treatment may also be complicated by the *impaction of a fragment in the sacculus*.

(4.) *Impacted Fragments of Stone in the Urethra*.—In the course of lithotrity, a fragment of stone which has escaped crushing, and may have an angular form, is apt to become impacted in the urethra; thus giving rise to severe irritation, which almost certainly excites alarming rigors, and may induce prostatitis or urethral abscess, cystitis or orchitis, or may even provoke a nephritic attack. The immediate removal of any such urethral fragment is, therefore, imperative. How this is to be accomplished will be guided by the seat of impaction. (a.) In the *prostatic urethra*, a fragment may be *pushed back* into the bladder, by the introduction of a full-sized, open-ended catheter, or by means of urethral injection. This manipulation failing, *median lithotomy* should be resorted to; and the incision will then be available for the more direct escape of the remaining *débris* from the bladder. (b.) When lodged in the *perineal* portion of the urethra, *external urethrotomy* is the more ready and safer method of removing the fragment; rather than by extracting it with a long, slender, urethral forceps. In either procedure, the urethra should be compressed behind the fragment, lest it recede into the bladder. (c.) In the *penile urethra*,—before the scrotum, the fragment can usually be *extracted* with the *forceps*; otherwise, it should be pushed back to the perineum, and there removed by urethrotomy,—a urethral incision in front of the scrotum generally resulting in a fistulous opening.

The impaction of a fragment is more liable to occur, in any portion of the urethra, when the bladder is irritable or subject to spasmodic action; and when coupled perhaps with some stricture of the urethra—the lodgement then being behind the seat of obstruction. Sometimes a fragment of stone is retained in the urethra, by spasmodic contraction, rather than by its shape and size.

In all cases connected with *spasm* of the bladder or urethra, opium and the warm bath are most efficacious in overcoming the difficulty.

DANGERS OF LITHOTRITY.—These are referable to the state of the *bladder and kidneys*, induced by the operation.

(1.) *Hæmorrhage* happens, sometimes, to an inconvenient amount for the free working of the instrument; though rarely to a dangerous extent. It arises from a highly congested state of the vesical mucous membrane, or possibly from the presence of some vascular growth in the bladder.

(2.) *Cystitis* ensues in some cases. This is usually the consequence of rough or prolonged lithotrity; but it may also arise from pre-existing prostatic or vesical disease, or from the retention of a fragment. The latter is sometimes associated with an enlarged prostate, behind which the fragment lodges; but the want of expulsion commonly depends on the atonic state of the bladder. Hence, any *débris* should be *washed out by injection*, in aid of the treatment for cystitis. Failing thus to remove fragments, lithotomy must be resorted to.

(3.) *Nephritis or pyelitis*, acute or chronic, of one or both kidneys, is not unfrequently a consequence of lithotrity. Commencing in the acute form, with rigors, this symptom, which might indicate an attack of cystitis or

the impaction of a fragment in the urethra, is now attended with pain in the loins, followed by uræmia.

(4.) *Atony of the bladder* occurs chiefly in *old* persons. The patient enjoys too quiet a state of the bladder after operation, the urine being retained with ease for several hours, owing to the loss of expulsive power. Chronic cystitis is very apt to supervene from retention of urine, in this deceitfully tolerant state of the bladder. On the other hand, this tolerance, from atony, permits the use of instruments, and the presence of fragments or of the stone, without much irritation; and the sudden emptying of an atonic bladder might induce an attack of acute cystitis. Hence, vesical atony is not altogether unfavourable for lithotripsy, and its after-treatment.

(5.) *Spasmodic retention* of urine sometimes follows the operation, and it occurs mostly in combination with an *atonic* state of the bladder, the vesical neck being the seat of spasm. Both are most frequent in *old* persons with enlargement of the prostate. The treatment of the spasmodic retention consists in giving a warm bath and then a full dose of opium. In either case, the urine must be drawn off with a large-sized catheter, rather than allow any accumulation in the bladder.

Retention from the impaction of coagula or a fragment in the neck of the bladder must be treated by catheterization.

(6.) *Suppression of urine*, with coma, is an occasional consequence of the operation, and probably depends on some previously existing latent disease of the kidneys.

CONSTITUTIONAL DISTURBANCES incident to lithotripsy may be comprised under rigors and febrile attacks, including pyæmic infection. (1.) *Rigors* not unfrequently set in immediately after the operation, especially after the first sitting, and last perhaps for some hours, terminating in perspiration. This attack is most common and severe when the operation has been prolonged, or the urethra overstretched, and not at all in proportion to the amount of pain. Subsequently, the lodgment of a fragment in the urethra is often the causative condition; and the treatment must be adopted, as already explained. A full dose of opium, or a tumbler of warm brandy-and-water, are the best remedies; the patient lying in bed and wrapped in a blanket. (2.) *Irritative fever* may ensue, which rapidly assumes a *typhoid* character; the pulse rising in frequency to beyond what can be distinctly counted, and becoming proportionately feeble and irregular, with a dry, hot skin, and dry, harsh, brown tongue. Commencing perhaps with rigors, and passing off with sweating in a few days, the fever sometimes assumes an intermittent or a remittent character. But this attack is more surely *fatal* than the most severe rigors. (3.) *Pyæmia* occasionally supervenes, probably in connection with suppuration as the result of damage done to the bladder. Pre-existing disease of the kidneys, attended with albuminous urine, always tends to induce these unfavourable or fatal constitutional consequences of lithotripsy.

Their TREATMENT mainly comprises the administration of opium and stimulants, with tonics—especially quinine.

Lithotripsy in Children is attended with certain difficulties, which, as objections to this mode of operation at an early period of life, should not be overlooked. The small size of the urethra, and irritability of the bladder, are unfavourable to the free working of the lithotrite; while the

neck of the bladder, the most dependent part of the organ, being very dilatable, and unobstructed by prostatic development, it allows the impaction of fragments. Hence, in performing the operation in children, the stone should be crushed into smaller fragments, or powder; and a small-sized evacuator, No. 8 or 10, should be used. *Peritonitis*, which rarely occurs after lithotripsy in adults, must be remembered as a not uncommon consequence at an early period of life. Small and soft stones are most suitable for the operation. It has been practised with success, both in male and female children. But the great success of lithotomy in young subjects has brought that operation into far more established repute, not to be set aside in the present state of experience (1889).

Comparative Mortality of Lithotripsy and Lithotomy.—Unquestionably the accumulating results of experience in lithotripsy lead to the conclusion that a far larger proportion of cases can fairly be submitted to this method of treatment than was formerly supposed, instead of to lithotomy. Taking the average mortality of lithotomy, at all ages, as 1 in 7, 8, or 9, lithotripsy can show the far lower death-rate of 1 in 12, in 15, or in 25—only 4 per cent.

Selection of Operation—Lithotomy or Lithotripsy.—Bearing in mind the average relative mortality of these two operations, it should also be remembered that their safety varies considerably according to the conditions which should regulate the Surgeon's judgment in the selection of the operation.

The conditions in question have reference to:—(1) The state of the urinary organs, and of the bladder and kidneys in particular; (2) the general health of the patient, and as connected with age; (3) the nature of the calculus—as to size and density.

When the bladder is healthy, and the kidneys free from disease, especially with regard to albuminous urine; the general health not deteriorated, and the stone friable, although of large size, all the conditions concur in favour of Lithotripsy. The opposite conditions are, of course, unfavourable in a greater or lesser degree; and would indicate, proportionately, the choice of Lithotomy—a hard, ringing stone being removed by the lateral operation; a large stone, by the supra-pubic operation; a small one, by the median operation.

Calculus in the Female.—Stone in the bladder is not of common occurrence in women, though not very rare. Crosse, at the Norwich Hospital, found the proportion to be 1 female to 19 males. Civiale finds the average to be 1 to 18; which may probably be taken to represent the general average. The probability is that stone forms more frequently than it is found, in the female bladder. This seems owing to the peculiar anatomical conditions of the urethra, which facilitate the escape of a small calculus. The urethra is short, almost straight, of large size, and readily dilatable, without any natural contractions in the canal; and there is no prostate gland at the neck of the bladder. Thence, a stone may form in the bladder, but more easily escape through the urethra.

SYMPTOMS.—In addition to the usual symptoms of stone in the male bladder, and the sure sign afforded by sounding, two special symptoms occur in the female. These are, bearing-down pains and pains along the urethra, and incontinence of urine,—a tendency to constant dribbling or wetting. Irritability of the bladder, from any of its various causes, or a

vascular urethral tumour, may give rise to similar symptoms; but sounding will determine the diagnosis.

TREATMENT.—The various operative procedures for removing calculi from the female bladder, are of three kinds:—(1) Dilatation of the urethra, or with partial slitting up of the urethra; (2) Lithotrity; (3) Lithotomy.

(1.) **DILATATION OF THE URETHRA** may be accomplished *rapidly* or *slowly*; by the former method when the stone is *small*, dilatation being accomplished in a few minutes; when the stone is *large*, it will be better to dilate slowly and gradually, in a day or two, until the requisite extension is accomplished. Rapid dilatation is not much more painful than the slower procedure; but it is more likely to be followed by *incontinence* of urine. Dilatation can be effected by various means; solid or flexible bougies, gum-elastic catheters, prepared sponge, or other tents; or by the cautious application of Matthews's female urethra-dilator—a three-bladed instrument, worked by a screw at the handle. After sufficient extension, a pair of forceps is introduced and the stone extracted. Stones of considerable size and weight have been thus removed from the female bladder.

Dilatation, with partial slitting up of the urethra—on one or both sides, is applicable when the former method has been carried to the farthest extent consistent with safety, and yet the stone is too large for extraction without thus dividing the urethra. Incontinence of urine not unfrequently follows.

(2.) **LITHOTRITY** is preferable to either of the above methods—urethral dilatation, or with incision combined—when the stone is of *large size*. This operation is far more easily performed in the female than in the male; and it is frequently more successful in its results; both these advantages having reference to the peculiar anatomical conditions of the urethral passage, already mentioned; coupled with the less dependent fundus of the bladder, owing to the absence of a prostate gland at the neck. A double depression may be found in the posterior and inferior wall of the bladder,—an anterior and a posterior receptacle, formed by the projection of the neck of the uterus; and in either cavity search must then be made for the calculus or fragments. In old women a depression exists behind the internal opening of the urethra, wherein some difficulty may be experienced in using the lithotrite. Parturition sometimes leaves a tendency to prolapsus of the anterior wall of the vagina, carrying with it the base of the bladder; and the organ is further subject to displacement and alteration of its cavity by uterine malpositions and enlargement. *After-treatment* in the female is, however, less liable to be attended with any difficulty by the retention of fragments in the bladder, or from impaction in the urethra; detritus and fragments of some size are readily discharged through the large and easily dilated urethra, facilitated also by the shorter and straighter course of the passage. But spasmodic contraction of the bladder is perhaps more often encountered than in the male, relatively to the number of cases submitted to operation.

(3.) **LITHOTOMY** is also more readily performed than in the male, and it may be done in either of four ways.

The patient is placed under chloroform, and tied up in the position as for the operation in males; and a grooved staff is introduced into the urethra, which is hooked up perpendicularly under the symphysis pubis.

A common bistoury, lithotomy-forceps, and scoop are the only other instruments required.

1. URETHRAL lithotomy is nothing more than incision of the urethra, carried up the passage, so as to divide also the *neck* of the bladder. Dilatation is then made sufficiently to allow of the completion of the operation by extraction. A *straight staff* having been introduced into the bladder, its groove is directed downwards and outwards towards the ramus of the ischium, and the *urethra divided obliquely downwards* with a probe-pointed bistoury. This incision often intersects a small portion of the anterior wall of the vagina. A bilateral section of the urethra has also been performed. Liston notched the neck of the bladder on both sides towards each ramus of the pubes, and then dilated for a few minutes until the finger could pass into its cavity.

2. LATERAL OPERATION.—A grooved staff, curved or straight, having been passed into the bladder, an *incision* is made on the *inner* side of the left *nympha*, from a point about half an inch above the urinary meatus, and carried downwards and outwards, *parallel* with the rami of the pubis and ischium. By touches with the knife between the rami and vagina, which is drawn inwards and *protected* by the left forefinger, the staff is reached just in front of the neck of the bladder; then, lodging the point of the knife in the groove, a slight urethral incision is made, inclining the blade downwards and outwards, and dividing the neck of the bladder. The opening can be enlarged with the finger sufficiently to introduce the forceps and extract the stone.

This operation has yielded successful results; the wound healing rapidly, and the patient having the power to retain her urine. Lateral lithotomy seems to be specially suitable in female *children*.

3. VAGINO-vesical lithotomy consists simply in making an incision through the vagina into the bladder, and thence extracting the calculus. A *curved* staff is used so that its convexity shall appear in the anterior wall of the vagina, while the posterior wall is depressed with a blunt gorget or a duck-billed speculum. In this method of operation the urethra is avoided, and afterwards a female catheter is introduced through this passage into the bladder, and the edges of the *vaginal incision* are brought together by *suture*. Vagino-vesical lithotomy is suitable for the extraction of *large* calculi, and in adults. There is generally no hæmorrhage, nor subsequent peritonitis; but *vesico-vaginal fistula* is a common result, unless the precaution be taken of closing the incision at the time of operation.

Incontinence of urine is apt to follow *all* these operations of lithotomy, although the last-named method is least liable to this result.

(4.) SUPRA-PUBIC lithotomy has been recommended in the female, as an occasional resource; when the stone is of *very large* size, or the *pubic arch contracted*, as from rickety deformity, or perhaps both these complications are associated.

During *Pregnancy*, the treatment of stone in the bladder presents a complication, both with reference to parturition, and the removal of the stone by operation.

As a probable occasion of difficulty in labour, the stone should be removed from the bladder, at the *earliest period*; and *lithotrity* will be preferable to any method of lithotomy, which may indeed be imprac-

ticable, owing to the altered relations of the parts, as the gravid uterus progressively enlarges. Either the urethral, or the vagino-vesical operation of lithotomy, will be the readiest method of gaining access to the bladder; rather than attempting to reach the bladder by the lateral operation.

When a calculus is discovered only *during parturition*, and it is of sufficient size to obstruct the passage of the child's head, the stone should be pushed back into the bladder, so as to lie above the brim of the pelvis, at the pubes. For this purpose, the urethra may be dilated sufficiently to admit the forefinger into the bladder. Failing thus to overcome the difficulty, recourse may be had to *lithotomy* by urethral incision, or by the vagino-vesical operation, for the removal of a large calculus. Under the circumstances, time will not allow of lithotrity.

Calculi of various sizes, and at different periods of pregnancy, have been submitted to operation; but although the stone has been removed successfully, death has not unfrequently occurred in consequence. This risk, however, is less serious than having to encounter the greater difficulty of dealing with a calculus during labour; and if craniotomy be resorted to in order to deliver the child, the danger of this alternative would have to be compared with that of removing the stone from the bladder, almost at the time of parturition.

CHAPTER LII.

DISEASES OF THE BLADDER.

THE Bladder is subject to Diseases, not differing in their nature from those of other organs; but which present modifications in their pathology and symptoms, and thence in their treatment. Thus, inflammation, known as Cystitis, acute and chronic; various Morbid Growths or Tumours and Tubercular deposit; may affect the bladder. Injuries, e.g. rupture of this organ, will also have to be noticed. Displacements, by prolapsus, and Malformations of the bladder are peculiar; and its Functional Conditions are special in their character; such as frequent micturition, retention of urine, incontinence or involuntary escape of urine, and engorgement with overflow of urine. These conditions may also be symptomatic of the diseases referred to, which involve structural alterations in the bladder.

Cystitis.—(1.) *Acute.*—The seat of inflammation affecting the bladder is primarily the mucous membrane; occasionally, in consequence of the intensity or duration of the process, the subcellular tissue and the muscular or middle coat may secondarily become involved; but inflammation never occurs in the middle and outer or peritoneal investment, independently of the mucous membrane. The portion of this membrane situated about the *neck* of the bladder is most commonly and severely affected; extending thence to the whole of the lining membrane.

SYMPTOMS.—The essential symptoms of acute cystitis are—severe pain

se of aching weight in the region of the bladder above the pubes, ng down the urethra into the perinæum and down the thighs; in is accompanied by a frequent, urgent, and soon intolerable desire the urine, which is expelled at short intervals, in small quantities, smodic straining efforts. These symptoms are those of simple *ility* of the bladder, in an extreme degree. But the *contracted*; forming a small, round, and firm tumour, is exceedingly painful ht pressure over the pubes, or when touched or tilted with the hrough the rectum or vagina, and the character of the *urine* also coloured and acid, mixed with mucus or pus, and perhaps tinged ood—indicates an inflamed state of the vesical mucous membrane. mptomatic inflammatory fever or constitutional disorder is often

e source of pus in the urine, with reference to whether it proceeds he bladder, kidneys, or urethra, is an important question of *diag*. Purulent urine, as from the *bladder*, exhibits a diffluent deposit, ich presents, under the microscope, an abundance of pus-cells; proceeding from the *kidneys*, the pus-deposit is similar in appear- ut it consists principally of pus-cells in the form of casts from the ous tubules,—as symptomatic of suppurative nephritis. *Urethral* distinguished by the appearance in the urine of threads, consisting rent pus-cells, which are thus twirled together, and expelled in eam by the act of micturition. The distinction between pus and is indefinite; the cells are very similar or identical; but the it or coherent character of the two deposits may differentiate them; when the urine becomes alkaline from ammonia, which converts e into a tenacious, mucoid matter. This, however, is characteristic *nic* cystitis.

itis usually commences suddenly and runs a rapid course; or it pervene on the chronic form of the disease.

USES.—Acute cystitis is commonly the consequence of an *extension* mmation from adjacent parts; most frequently from the urethral s membrane, by gonorrhœal inflammation extending backwards to k of the bladder, in retrocedent gonorrhœa; or more severe inflam- may have extended from the prostate, the rectum, or the kidneys. s comprise—blows and pelvic fractures, operations of lithotrixy, ged catheterism, injections, and lithotomy; in the female, prolonged trumental labours; also the mechanical *irritation* of calculus, or oreign body; the chemical action of cantharides and of some mineral s, and strong diuretics; the action of the urine itself, from over-, or from distension, when retained and decomposed, as in stricture atic enlargement. The disease arises also sometimes from *gout*, or xposure to *cold*. Any person subject to chronic cystitis is liable to e attack.

TERMINATIONS.—Resolution; or the disease may subside into the e form, suppuration in the wall of the bladder, leading to peritonitis, een the bladder and rectum, followed by urinary infiltration in the r tissue of the pelvis or of the perinæum; ulceration, or gangrene mucous membrane, in the worst cases.

TREATMENT.—Remedial measures consist in *derivation*, *diluents* and s to render the urine unirritating, and the influence of opium.

(a.) Thus, perfect rest in the recumbent position will relieve the bladder of the whole weight of the upward column of blood; and this derivative effect may be aided by leeches to the perineum, and warm fomentations to the abdomen, or by means of a hot-water bag, which covers both the hypogastrium and perineum. Hot or warm enemata also sometimes afford relief. Laxative aperients, such as castor oil, preceded by a dose of calomel at the beginning, will further derive from the bladder and keep the bowels free from irritation. (b.) Diluent drinks, such as barley-water, or milk, should be liberally allowed; and the citrate or nitrate of potash, largely diluted. Thus, the citrate may be taken in doses of a scruple to half a drachm, three daily, so as to keep the urine neutralized. Of course, the quantity of any fluid allowed should not be such as to provoke frequent micturition. (c.) Opium may be advantageously administered in the form of enema or a suppository, thus to allay the distressing vesical irritability; while the continued influence of opium, taken internally, tends to subdue pain and inflammation. Belladonna, hyoscyamus, and scopolia have also some reputed efficacy, whether as administered by the mouth or per rectum. The combination of a sedative with an alkali is often convenient; and the joint action of hyoscyamus with liquor potassæ may be specially recommended,—given perhaps in the form of a diluent drink.

If cystitis be the consequence of retrograde gonorrhœa, the return of vesicular discharge should be solicited by warm fomentations to the penis, or wrapping it in a poultice. When the urine is acid, and its sediment yellowish and not coherent, but purulent, a pill of calomel, two grains, with half a grain of opium, may be taken twice or three times a day. When the urine is alkaline, and deposits a small quantity of brownish adhesive mucus, the vinum colicidii may be given in fifteen-minute doses, three daily for three or four successive days.

Cystitis resulting from emphysema locally or internally absorbed, comes on usually within two to four hours after the dose; the symptoms of pain in the loins with bloody urine, soon reach their maximum of intensity, and subside in from six to twelve hours. Bicarbonate of potash and full doses of hyoscyamus should be given every half-hour for three or four hours, and perfect rest enjoined. If a blister has been the cause, it must be removed at once, and the surface thoroughly sponged free of every particle of antiseptic.

(2.) **Chronic Cystitis.**—This form of the disease presents two varieties: inflammation of the vesical mucous membrane, with very slightly increased mucous secretion, or with an abundant secretion of mucus-purulent matter,—in either case, of an alkaline character. The one condition is simple chronic cystitis; the other is known as catarrh of the bladder, or cystitis. In both varieties, especially the catarrhal, the vesical membrane has become thickened, velvety, and of a dark colour, perhaps encrusted with white phosphatic deposit; the vessels are dilated or congested, and the muscular coat is more or less hypertrophied.

Symptoms.—The same symptoms are exhibited in both states of chronic inflammation; and modified only in degree from those of acute inflammation. The chronic catarrh of the bladder is distinguished by the discharge of thick mucous, greyish mucus-purulent matter in the urine, in greater or less abundance, and which gradually subsides to the bottom of the vessel

which it is collected. Under the urine, it appears as a semi-transparent, whitish, tenacious jelly, something like parboiled white of egg; on pouring off the urine, it hangs slightly adherent to the vessel, and slides down suddenly in a lump; or it can be poured from the vessel in long coils, resembling macaroni. This ropy form of mucous deposit may be tinged with blood, or present white streaks of phosphate of lime, being insoluble in the alkaline secretion. The *urine* itself, acid at first, becomes brownish, ammoniacal, and fetid—from decomposition of the pus, which consists of carbonate of ammonia with two atoms of water. The transformation of urea seems to be induced by the mucous secretion acting as a ferment upon the retained urine; while the ammoniacally impure state of the urine, thus evolved, is itself an irritant to the vesical mucous membrane, and reacts as a cause in maintaining the cystitis. Like the fixed alkali—soda or potash—of the mucous secretion, this free alkali—ammonia—transforms the pus into ropy mucus or mucoid matter, and precipitates the phosphates of ammonia and magnesia or the free phosphate, which also characterizes the urine of chronic cystitis. A pyrexial febrile condition accompanies this advanced stage of the disease; of shivering mark the accession of pyæmic infection, the pulse becoming extremely rapid and feeble, the tongue dry and brown, with prostration and cerebral oppression; or suppression of urine is followed by hæmaturia, attended with similar symptoms.

CAUSES.—Acute cystitis may subside into the chronic or persistent form of inflammation. But chronic cystitis often arises independently, from any cause of *long-continued irritation* of the bladder;—from calculi or other foreign bodies—including pus or blood in the urine, as dependent on kidney-disease; or from tumours in or adjoining the bladder; or from stricture of the urethra, or extroversion of the bladder; neuralgia of the vesical neck; or from the retention and decomposition of urine; as in stricture of the urethra, or enlargement of the prostate, or in spinal paralysis. The retention of urine is not only a cause of retention—it also induces an inflammatory state of the vesical mucous membrane by *impaired innervation*. The relief of habitual over-distension with atony of the bladder, is apt to excite chronic cystitis; not from the loss of innervation, but of vascular action from compression by the retention of urine.

TREATMENT.—The same plan of treatment is appropriate as in acute cystitis, only modified in degree. It comprises *derivation* from the bladder, correction of an irritant state of the *urine*, and the influence of opium to allay pain and vesical irritability. (a.) Counter-irritation may be employed by means of a mustard poultice or iodine-paint, applied to the supra-pubic region; or a blistering liquid of cantharidine in chloroform, to the perinaeum, when the neck of the bladder, more particularly, is affected. I rarely have recourse to any such derivative treatment. But the abundant discharge of mucus or muco-purulent matter and the impure state of the urine, which especially characterize chronic *catarrhal* inflammation of the bladder, render certain special treatment necessary; to arrest the secretion from the mucous membrane and to correct the impurity of the urine. Pareira brava, a concentrated decoction, uva ursi, or infusion of buchu, given with the mineral acids, are more or less efficacious; I much prefer the concentrated decoction of pareira with diluted nitro-muriatic acid in ten or fifteen minim doses. Benzoic acid

also renders alkaline urine acid. Any *acid* is suitable only when the urine is itself alkaline, rather than when it subsequently becomes so by admixture with alkaline mucus in the bladder. Then, alkalis should be administered, to correct the acidity of the urine, which otherwise, as an irritant, would maintain the vesical inflammation and thence the secretion of alkaline mucus. I have found gallic acid useful in arresting the secretion of ropy mucus, and Niemeyer speaks highly of tannin. *Injections* are highly serviceable, when no acute symptoms are present. They may be *sedative*, as decoction of poppies, in quantities of not more than two ounces, and retained for half a minute once a day; or *astringent* injections, as diluted nitric acid, ten minims gradually increased to twenty in two ounces of water, and allowed to remain for a few minutes. Carbolic acid, in the proportion of only two or three drops to half a pint of water, as an injection, is said to have a corrective influence on the urine, when fetid. By these measures, coupled with tonics and a generous diet, to support the dread exhaustion of chronic cystitis, we may succeed in arresting the progress of the disease to a fatal issue. In conjunction with this course of treatment, the removal of any cause in operation must obviously be a primary consideration. Hence, the treatment for stone or other foreign body in the bladder, or perchance a tumour in this organ; and the various causes of retention,—from stricture, enlarged prostate, or paralysis.

Cystotomy has been practised occasionally for the relief of chronic cystitis; the bladder being opened, by an incision as for median lithotomy, and a tube introduced, to drain off the urine, and muco-purulent secretion; thus to prevent any accumulation in the bladder. Upon the principle of keeping the organ at rest, the diseased state may subside, and with it, the exhausting constitutional disturbance. But the operation itself involves a certain amount of risk, and the continued use of a tube, for some

time, in the neck of the bladder, is more or less a source of irritation. Cystotomy has afforded temporary relief, or no relief; and cystitis has returned on the closure of the wound.

Tumours of the Bladder.—Three diseases comprise—(1) Fibrous growth, of a warty or of a polypoid character; (2) Villous or vascular growths; (3) Cancer; encephaloid, scirrhus, epithelial, colloid; (4) Cysts.

(1) **Fibrous Growth** springs from the mucous membrane and submucous tissue, and consists of their elemental structures. It commences in the form of a *circumscribed elevation* of the mucous membrane, resembling a warty growth, and subsequently enlarges, protrudes, and assumes a polypoid form (Fig. 128).

The **Scirrhus** are those arising from any cause of pain and irritation, with perhaps obstruction to micturition; and there is also the presence of a *foreign body* in the bladder. Stimulating stone, careful ascending to dis-

* *Rep. Coll. Surg. Mex.*

FIG. 128.*



cover the situation and form of the growth may show distinctive characters. Phosphatic deposit encrusting the growth may, however, still mislead as to its true nature; but the *fixed position*, and impossibility of passing a sound *around* the tumour, free of the bladder, will aid the question of diagnosis. Yet, the resemblance to an *encysted* calculus is even then, I am sure, sufficiently perplexing to perhaps baffle the most careful exploration. When seated at the *neck* of the bladder, a polypoid fibrous tumour, having a firm consistence, may be easily mistaken for an *enlarged middle lobe* of the *prostate*, or a polypoid out-growth.

This species of growth is most common in children and young persons. The *absence of blood* in the urine, or in any notable quantity, distinguishes warty or polypoid growth from both the remaining species—villous growth and cancer.

TREATMENT is palliative, to allay pain and vesical irritability, with the use of a catheter when necessary. Polypus of the bladder has been removed by Aveling's polyptrite. Supra-pubic cystotomy may be performed for the removal of vesical polypus; or perineal section, as by median lithotomy, for exploration of the bladder, and for the removal of such a tumour, when found to be practicable.

(2.) **Villous Growth** springs also from the mucous and submucous tissues, and consists of cellular elements and large looped capillaries. It presents in the form of innumerable fine villous processes or tufts, which branch off from the base in every direction. Floating in water, this growth appears as a *soft, flocculent* body, about the size of a large marble when fully developed. It is usually on the *base* of the bladder. Several such tumours may co-exist, giving to the interior of the bladder a studded, villous appearance.

The SYMPTOMS are not peculiar, either with regard to obstruction or the presence of a foreign body in the bladder; and, owing to the *soft* and yielding character of the growth, these symptoms are less marked. But the *pain* and *vesical irritability* are much aggravated; and the abundant, oft-recurring draining hæmorrhage, or *bloody urine*, distinguishes this species of growth from polypus. *Shreds* of the tumour are also apt to appear in the urine, which examined by the microscope, will confirm the diagnosis.

TREATMENT is palliative, as for polypus. *Astringent* injections may perhaps be used, as weak solutions of acetate of lead or nitrate of silver; and astringents taken internally, as gallic acid, may prove serviceable in arresting the tendency to hæmorrhage. *Tonics*, especially iron and quinine, with a nutritious diet, in conjunction with *opium* internally and per rectum, will be requisite to support the patient under the exhaustion resulting from long-continued pain, irritability of the bladder, and hæmorrhage. The introduction of any instrument must be avoided as much as possible; sounding is less effective in the diagnosis of a growth so soft and flocculent; catheterism aggravates the pain and irritation, and may provoke bleeding; while the *removal* of a villous growth would be equally hazardous and ineffectual.

(3.) **Cancer** of the bladder is more common than the last-named species of growth. It may be primary, commencing in the bladder, and springing usually from the *base* or *neck*, but originating in the submucous tissue; or secondary, extending from the prostate, the rectum, or the uterus.

The species is most frequently *encephaloid*, and usually so when originating in the bladder, always of this kind when spreading from the prostate; *scirrhus*, when spreading from the rectum or the uterus, or *epithelial* cancer from the latter organ. *Colloid* is more rare; but in *post-mortem* examination I have met with this species of cancer occupying the whole interior of the bladder, as a semi-transparent, greenish-yellow, trembling mass of jelly; as if the organ were fully distended with urine. Similar colloid deposits were found in the uterus and rectum, and in most of the abdominal viscera.

SYMPTOMS.—The pain of cancer in the bladder is very severe, but scarcely ever lancinating; and is referred to the lower part of the belly, to the loins, hips, thighs, and perineum. *Vesical irritability* is so active, that the urine is ejected every few minutes; and when ulceration of the mucous membrane ensues, it is expelled with sweating agony. The semen also may be emitted, and the contents of the bowel evacuated, or the bowel itself protruded, during the writhing effort to strain off the last few drops of urine. Profuse, gushing *hemorrhage*, or *bloody urine* and of an alkaline, fetid, purulent character; with perhaps the appearance of *mucous cells* in the urine; are tolerably distinctive of cancer-growth in the bladder. *Examination* with the finger, *per rectum*, may discover a tumour in, or involving, the base of the bladder,—and differing in consistence, size, shape, and position from enlargement of the prostate. But the presence of a solid tumour in the situation of this organ at the lower part of the abdomen, is characteristic of cancer; excepting when a non-malignant growth has attained to such size as to occupy the bladder,—a rare event. Then the *diagnosis* will turn on the general severity of the bladder-symptoms, aided, perhaps, by the appearance of the cancerous structural elements in the urine. But it may be difficult to distinguish cancer-cells from rudimentary forms of vesical epithelium, unless a mass of infiltrated papillæ be discharged. At length the urine may contain feculent matter, the cancer-growth having ulcerated into some portion of intestine. Age and sex help to guide the diagnosis. Thus, *scirrhus* most frequently occurs in men, and between forty-five and sixty years of age. Constitutional symptoms, with *glandular enlargements* in the iliac regions, may supervene in an advanced stage of the disease; but the peculiar cancerous cachexia is even then not well marked. The patient's general health and aspect is that of a person worn down simply from pain, sleeplessness, and loss of blood. *Calculus* sometimes co-exists with cancer, especially *encephaloid*; and the presence of a stone may be detected by sounding, which at the same time discovers a tumour; if the mass bleeds readily in gently exploring with the instrument, it will probably be *encephaloid*.

TREATMENT.—Palliative measures only have any effect; comprising opiates, administered internally and sometimes by hypodermic injection; or by suppository, *tonics*, and *supporting diet*. Retention must be relieved by careful catheterism, with an elastic instrument. Thus the resources of experience may yet ease the way, as the plough of pain nears the end of the furrow. The disease is invariably fatal.

(4.) **Cysts** are occasionally met with, in the walls, or in the cavity of the bladder. As new formations, they must be distinguished from the sacculated condition produced by mechanical dilatation, in the habitual retention of urine from stone or urethral structure. The false membrane

which sometimes forms a cast of the bladder in cystitis, is also a spurious form of cyst. True cysts are sometimes *dermoid*, containing teeth and hair. These formations have probably entered by ulceration through the walls of the bladder. Any vesical cyst may become the nucleus of calculous deposit; or some of its contents may be discharged in the passage of urine. *Hydatid* cysts have also been found in the bladder.

The DIAGNOSIS of a vesical cyst must necessarily be obscure, unless the escape of its contents per urethram should offer the opportunity for inspection or microscopic examination.

Tubercle of the bladder is a very rare affection; probably never occurring unassociated with tubercular deposit in other parts of the body, and of the genito-urinary system especially; the kidneys and prostate, in particular, being similarly affected. Occasionally, the testis, epididymis, or vas deferens and seminal vesicle are enlarged, nodulated, and indurated with the deposit. Sometimes, the lungs or intestines are the seat of disease. In women, it has been known to have followed primary disease in the uterus.

The SYMPTOMS are not peculiar, and the diagnosis is chiefly negative. Great pain, and extreme irritability of the bladder; with the absence of obstruction to micturition, and of a calculus or other foreign body, of hæmorrhage in any quantity, and of any perceptible tumour; together with the presence of tuberculosis, and progressive emaciation. These circumstances, taken in conjunction with the patient's age—usually early or middle adult life—will indicate the nature of this disease. The symptoms of chronic cystitis are associated.

The interior of the bladder presents different appearances, according to the stage of the disease. Tubercular deposit may be found, in the form of small granulations, seated in the mucous coat of the bladder, and more often at the base or neck of the organ. These points may have coalesced, but they continue in a chronic state for a long period. In an advanced stage, the tubercular matter softens, and the mucous membrane gives way, forming an ulcer of variable size, but having a ragged undermined margin, infiltrated with deposit. Tubercular matter is now discharged in the urine, which can be recognized with the eye, or detected with the aid of the microscope; thus at length declaring the nature of the disease. Ultimately, the extent of ulceration may be such as to destroy nearly the whole of the mucous membrane; and then a very large, ragged ulcer is found after death. Rarely, perforation takes place, and extravasation of urine.

TREATMENT must have reference to the constitutional disease—tuberculosis, and the remedies for chronic cystitis. But the prognosis is very unfavourable.

Hæmaturia.—Blood in the urine, or simply bloody urine, is a *symptom* only of disease in some part of the urinary organs. Varying in quantity, from a small proportion discoverable only by the microscope, to an amount constituting the greater portion of the fluid passed, the admixture of blood and urine may be estimated by corresponding differences in the *colour* of the urine. When blood is present in *small* quantity, the urine has a brownish or smoky tint; and deposits a reddish-brown sediment on standing. In *large* quantity, the urine has a dark-brown, muddy colour, like chocolate; and deposits a red sediment, adhering to

the bottom of the vessel. Intermediate tints are met with, according to the admixture of blood. On pouring a suspected sample of bloody urine into a test-tube, the smoky or darker chocolate tint is even more clearly seen. Heat coagulates the blood into a brownish-grey deposit, leaving a clear fluid above; and microscopic examination exhibits the characteristic red blood-discs. These tests, especially the latter, will show the presence of blood in the urine, and thus distinguish hæmaturia from simply dark reddish-coloured urine, due to other causes—bile, rhubarb, and other colouring matters, or to mere concentration of the urinary secretion. When nearly pure blood is passed, the urine appears as such, and retains almost the same appearance on standing.

The source of the blood in hæmaturia, and thence the seat of the disease, may be any one or more of the following parts:—(1) the kidney; (2) the pelvis of the kidney; (3) the ureter; (4) the bladder; (5) the prostate; (6) the urethra.

CAUSES.—Diseases of the kidney, acute and chronic; *injury*, as blows, or strains, in the loins; cancer or calculus in any part of the urinary tract—the kidney, ureter, bladder, prostate, or urethra; violent diuretics, as turpentine or cantharides; cystitis; varicose vesical veins occasionally; villous tumour of the bladder; prostatic disease; stricture of the urethra; urethral chancre; chordee; local application of mechanical and chemical agents; the hæmorrhagic diathesis; certain blood-diseases, as fever or purpura; vicarious hæmorrhage from the bladder.

The diagnosis of the source of blood in the urine is the same as of these causative conditions. But the general ground of distinction is this:—when hæmaturia is renal, the urine will be uniformly mixed with the blood, and perhaps casts of the uriniferous tubules; when it is vesical, or prostatic, the first portion of urine that passes, or that is drawn off by the catheter, will be pale and less bloody than the last, and at the termination of the stream, pure blood only may escape; when proceeding from the urethra, the blood may be mixed, but more often unmixed, with urine, passed also in the form of worm-like clots or casts of the urethral canal, and independently of micturition.

TREATMENT must always have reference to the cause of hæmaturia—the disease whence the blood emanates. The general remedial measures are rest, the recumbent position, and *astringents*. Gallic acid in particular, sulphuric acid, acetate of lead combined with opium, or Ruspini's styptic, may severally be administered internally. In vesical hæmorrhage, oil of turpentine is specially efficacious; in doses of from ten to fifteen drops, suspended in mucilage. Cold may be applied to the hypogastrium, perineum, or within the rectum by injection. I am in favour of ice-cold water enemata. The management of the blood collected in the bladder has given rise to a diversity of opinion. It is recommended that the coagulum should be broken up and withdrawn, by the introduction of a full-sized catheter to which a syringe is then applied, the blood being thus gradually extracted by suction; or the bladder can be washed out with cold water, by means of a large-eyed double-current catheter. Generally, however, this disturbance of the clot would seem to be unnecessary and prejudicial. Its removal is apt to reopen the vessels and renew the hæmorrhage, while the solvent action of the urine will most safely and effectually bring away the blood. Opium may succeed in

controlling the urgent desire to micturate; and when absolutely necessary to relieve retention of urine, surgical interference can be resorted to.

Endemic Hæmaturia.—Blood in the urine may proceed from the presence of a minute, filiform worm, of the nematoid kind,—*Bilharzia hæmatobia*, which infests the veins of the portal and urinary systems; especially inhabiting the veins of the bladder, ureters, and pelvis of the kidneys. This specific cause of hæmaturia is unknown in this country—otherwise than occasionally in persons who have travelled from parts where the disease originated; but it is of common occurrence in Egypt, the West Indies, and the Mauritius; and is not unfrequent on the south-east coast of Africa; localities where the disease is known as endemic hæmaturia.

How the parasite gains admission to the body may be doubtful; through the stomach, by drinking water containing the ova or the worm in an early stage of development, would seem to be the common mode of invasion.

The SYMPTOMS of the disease are, the passage, with the last ounce of urine, of a little blood, rarely more than a teaspoonful; or bloody, or colourless mucus, moulded so as to resemble "veins." These latter sometimes cause a little obstruction, and give rise to straining. When the parasite inhabits the kidney, an occasional smart twinge of lumbar pain is felt. The urine is clear and pale-coloured, the blood being rarely or never diffused through the bulk of it. After exertion, the quantity of blood is increased. But the discovery of the characteristic ova in the urine or the mucus, will be diagnostic of the cause of hæmaturia. During the earlier years of the disease no other pain or inconvenience is experienced. The disease attacks both sexes, at about the age of ten. Thus, in schoolboys—of whom two out of every three are affected—their linen is commonly blood-stained, like that of the other sex from the menstrual discharge. But adults are also liable to this hæmaturia. After a few years, the hæmaturia gradually declines, disappearing usually at the age of puberty; but the cause, as manifested by the presence of ova in the urine, continues, and in time gives rise to severe symptoms of gravel. The urine assumes a highly saline condition, and crystalline deposits, chiefly oxalate of lime, form around the ova which the parasite produces in great abundance. The eggs thus become the nuclei of renal calculi.

TREATMENT should be directed to kill the parasite, or expel it or the ova from the body. Both these obvious indications are at present, however, beyond the power of therapeutic fulfilment. Dr. John Harley suggests the administration of belladonna or hyoscyamus, as possibly efficacious vermicides; and their action would certainly be increased by the elimination of atropia and hyoscyamia only through the kidneys; while the sedative influence of these agents might relieve the renal and vesical irritation arising from the expulsion of ova. As a means of preventing the systemic infection, filtered or boiled water should be drunk; and any contamination of the water thus used, by admixture with urinary excretion, should be carefully avoided.

Injuries of the Bladder.—(1.) **Wounds.**—The bladder is subject to wounds—whether incised, lacerated, or punctured—and rupture; but such lesions are of rare occurrence.

The Effects of laceration or rupture of the bladder vary according to the seat of injury, as above or below the reflexion of the peritoneum; whereby extravasation of urine takes place into the peritoneal cavity, or into the cellular tissue of the pelvis. In the one condition, fatal *peritonitis* speedily ensues; in the other, *diffuse inflammation* is followed by sloughing of the cellular texture of the pelvis and abdominal wall as infiltration proceeds, and a less rapid and surely fatal termination. A small wound, and having an oblique direction, may allow of little or no urinary extravasation.

The Symptoms of ruptured bladder are obvious; abdominal tension, sudden and intense burning pain in the hypogastric region, with immediate collapse, constant desire to micturate and defæcate, and *inability* to pass water, or a little *bloody urine* coming away through the urethra. On introducing a catheter, the bladder is found to be empty, or a small quantity of bloody urine is drawn off. If the instrument passes through a rent into the peritoneal cavity, more bloody urine may be drawn off, the stream ebbing and flowing with the respiratory movements. Warm water injection is felt by the patient in the abdomen. In gunshot wound implicating the bladder, the urine may perhaps be seen to escape through the track of the wound.

TREATMENT.—Extravasation should be immediately prevented extending further, by the introduction of a full-sized gum-elastic catheter into the bladder—which is retained by means of tapes—that the urine may dribble away as fast as it descends into the bladder. Any appearance of extravasation presenting externally, must be at once met by free incisions, so that the infiltrated fluid shall escape, and sloughs also as they form. The *lateral* operation, as for stone, affords a more free drain to the urine when the vesical laceration is outside the peritoneum. When the peritoneal pouch behind the bladder is the seat of extravasation, as indicated by its fulness and fluctuation, the urine should be drawn off dependently, by puncture with a long trocar and cannula, through the lateral incision. Peritonitis, consequent on extravasation into the peritoneal cavity, will also be diminished by puncture of the cul-de-sac, through the lateral operation. *Cystotomy*—as thus performed—is a more promising method of treatment than a supra-pubic operation, for the evacuation of urine from the peritoneal cavity. But then the rent in the bladder can be closed by a continuous catgut suture. The general treatment consists in the administration of opium and stimulants, with whatever nourishing food the stomach will accept, to sustain the patient through the subsequent exhaustion, especially in the process of sloughing.

(2.) *Foreign Bodies*.—Various foreign bodies, such as portions of catheters, or bits of pencil or tobacco-pipe, glass, or wax, are occasionally thrust into the bladder, through the *urethra*. Catheters, whether metallic or old elastic, which have become brittle, are apt to break in the curve or near the eye, while using the instrument. Any substance, thus introduced, is usually of some length, and lying perhaps across the bladder, is rarely expelled in passing water; it must therefore be extracted surgically. This may sometimes be done with a *lithotrite*, by catching the body in the direction of its long axis, or by crushing it as a stone; but sometimes—when the substance is soft or brittle—recourse to the operation of lithotomy will more surely remove it, without leaving a

portion or fragment behind in the bladder. Knowing the size and shape of the foreign body, the *median* operation can be more frequently selected. *Bullets*, bits of clothing, or other bodies, are occasionally lodged in the bladder by gunshot wound, implicating this organ. Any such body must be removed in like manner.

In the *female*, foreign bodies can be removed more readily from the bladder, owing to the urethra being of larger size and more dilatable, while the shorter extent and straighter course of the passage also facilitates extraction.

In all cases, a foreign body in the bladder soon becomes encrusted with urinary deposit; and by thus increasing the difficulty of its extraction, and as a persistent source of irritation, inducing an unhealthy state of the bladder, the result of any operative procedure might be unsuccessful.

(3.) **Displacements.**—1. **PROLAPSUS** may occur in females, the bladder falling down with the anterior wall of the vagina, in the form of a rounded swelling within the labia, or perhaps appearing externally between the thighs. This *tumour* is soft and fluctuating to the touch, especially when pressure is made above the pubes; and the transverse rugæ of the vagina may be seen, unless the swelling be very tense. The *compressible* character, and the size of this vaginal swelling, will vary with the more or less distended state of the bladder; and after micturition, only a lax condition of the vaginal wall may remain. Passing the finger on to behind the tumour, the os uteri may be felt, having a direction downwards and backwards; and this uterine displacement arising from the bulging tension of the vaginal wall, in front, there can be no doubt that the case is not one of prolapsus uteri, and which is a more common affection. Prolapsus of the bladder is attended with some bearing-down sensation,—stretching even from the navel, when the bladder is full; and constant vesical irritability urges to frequent and straining micturition, but with incomplete effect, as the fundus of the bladder still remains full; and while repeated efforts gradually increase the prolapsus, partial retention of urine at length provokes chronic cystitis. A *catheter* is introduced, and then—in addition to the vaginal tumour and vesical symptoms—the Surgeon can plainly feel the point of the instrument in the vagina, when turned down into the fundus of the bladder; and from which receptacle a quantity of urine may be drawn off, below the level that the patient could expel. By *tilting up* the vaginal wall with the fingers, the bladder is readily emptied; and this natural mode of relief, aided by an inclined position forwards, the patient may herself have learnt by experience.

The *Cause* of this prolapsed state of the bladder is soon discovered. The patient has a large, relaxed vagina; which may be the result of anything that has impaired the natural tone of the passage. Commonly arising from repeated pregnancy, and tedious or difficult labour, this state of the parts is found mostly in women who have borne many children, and in rapid succession. Sometimes also, in women who are weakly and subject to leucorrhœa, the vagina is naturally so lax that prolapsus of the bladder seems to be ever impending.

TREATMENT.—It may be possible to brace up the relaxed vaginal wall; either by the contraction of a cicatrix, resulting from cauterization; or by removal of a portion of the mucous membrane, in the form

of an excisional operation, with closure or coaptation of the exposed surface.

The *actual cautery* having been applied to the anterior wall of the vagina, produces a slough, followed by cicatrization, which may afford sufficient support to the bladder. But in thus removing a portion of the vaginal mucous membrane, the superficial area, and even the depth to which the sloughing process may extend, is less certain, than by removal of the mucous membrane with the knife.

Various *excisional* operations have, therefore, been devised—for the description of which the Student is referred to the Author's larger "Surgery."

Prolapsus of the bladder, through the *urethra*, in the female, is a very rare form of displacement, yet practically important, as the projection may be *mistaken* for a polypoid urethral growth.

2. *HERNIA* of the bladder, alias *Cystocele*, is another displacement of very rare occurrence. The protrusion may take place in either of the ordinary situations, as *inguinal* or *femoral* hernia; but it has been met with also as a *perineal*, an *obturator*, or an *ischiatric* hernia. In the female, femoral and *vaginal* cystocele occur, although rarely. A *tumour* of a softened compressible character appears, say, in the groin, and descends into the scrotum; thus resembling an intestinal protrusion—an *enterocele*. But certain peculiar and *distinctive symptoms* may be observed. The size of this swelling is scarcely affected by coughing—and which gives only a slight impulse—nor by the position of the patient, standing up or lying down; the swelling varies in size as the bladder is emptied, and fills again. On compressing the tumour during the act of micturition, or with a catheter in the bladder, the *quasi*-intestinal protrusion subsides; but it returns with the reaccumulation of urine. The unaided act of micturition may not reduce the swelling, for the protruded portion of the bladder still remains full of urine; and this partial retention is attended with incessant vesical irritability, and frequent desire to pass water—another symptom which distinguishes cystocele from intestinal hernia. A *scrotal* cystocele may simulate hydrocele—both are fluctuating tumours; but hydrocele is irreducible, except when congenital, and then the transparency of the distended tunica vaginalis may contrast with the opacity of a protruded bladder.

Sometimes, an ordinary intestinal and omental *hernia* co-exists, and this protrusion descends in front of the cystic, behind which lies the spermatic cord. In some cases, the protruded portion of the bladder has contained not only urine, but also one or more *calculi*, formed apparently in consequence of retention and vesical catarrh. With any symptoms of stone, sounding then, of course, will not detect the calculus. When situated in the groin, as a *cystic bubonocoele*, the stone has been mistaken for a bubo.

The *TREATMENT* of cystocele is simply that of hernia; the protrusion should be *reduced*, and kept up by a *truss*; or, when irreducible, a suspensory bag must be worn, and the herniated portion of bladder should be compressed during micturition.

In the event of an *operation*—owing to strangulation, the Surgeon will remember the peculiarities of the hernia with which he has to deal;—the absence, usually, of a peritoneal sac to the bladder; and the possible

co-existence of an intestinal hernia, with a sac, overlying the cystocoele, which may have become thickened and otherwise changed. Should the vesical protrusion contain a *stone*, this should be returned into the cavity of the bladder, and afterwards removed by lithotomy or lithotrity. But a stone has been extracted by direct incision into the protruded portion of the bladder, and no unfavourable symptoms followed this method of operation.

Malformations.—Malformations of the bladder are of three kinds:—(1) absence of the organ, with certain abnormal deviations of the ureters; (2) their direct communication with the urethra, (3) with the rectum, (4) with the vagina; (5) bipartite bladder, or the co-existence of two or more bladders; (6) *extroversion* of the bladder, arising from a congenital absence of the anterior wall of the organ, with corresponding deficiency of the anterior wall of the abdomen, thus exposing the posterior wall of the bladder as a prominent projection. (Descriptions and Operations in Author's "Surgery.")

CHAPTER LIII.

DISEASES OF THE PROSTATE.

THE Prostate Gland, surrounding the neck of the bladder and commencement of the urethra, is subject to certain Diseases: Inflammation or Prostatitis, acute and chronic; Hypertrophy or simple enlargement, in advanced age; Atrophy; Cancer; Cysts; Tubercle; Calculus.

Prostatic affections are often associated with diseases of the bladder, especially cystitis and stone; so that, in practice, these diseases are frequently found in the same patients.

Inflammation of the Prostate, or Prostatitis.—Acute prostatitis rarely occurs unconnected with inflammation of the bladder or of the urethra.

SYMPTOMS.—A sensation of weight and fulness is experienced about the *neck* of the bladder, rectum, and perinæum; frequent and painful micturition, the pain increasing towards the close of the act, and extending down the urethral passage towards the glans; the stream of urine is small and ineffectual, the urine itself sometimes being blood-stained as it ceases to dribble; there is also a constant straining desire to evacuate the bowel, and great pain in defæcation, the motions having a somewhat flattened form; while an *enlarged* and *exquisitely tender*, and perhaps throbbing, state of the prostate is discovered by examination with the finger introduced into the *rectum*. The accompanying inflammatory fever is often very acute; commencing with rigors, and leading to a high degree of constitutional disturbance.

As the prostate enlarges, micturition becomes difficult, and total *retention* may ensue from the obstruction. An attempt to pass an ordinary catheter meets with some opposition, and produces great pain, when the instrument reaches the neck of the bladder.

CAUSES.—Prostatitis is usually a consequence of *gonorrhœa*, the

urethral inflammation extending upwards to the prostate, or of stricture of the urethra, or of *injury* in the violent use of stricture or lithotripsy instruments; or it results from the *irritation* of a *calculus*, strong injections, or cauterization of the prostatic urethra. Cold and damp to the perineum will also give rise to it, and especially in *gouty* or rheumatic subjects. As occasional causes may be mentioned—alcoholic drinks and inordinate sexual excitement, when, in either case, urethritis already exists, or hard riding on horseback. As an idiopathic inflammation it is very rare.

TREATMENT.—*Local blood-letting* from the perineum affords the greatest relief. Ten or twenty leeches should be applied, or cupping performed to the amount of six or eight ounces; followed by warm poppy-head fomentations and hip baths. Pain and vesical irritability are best relieved by *opiate suppositories*; as of pil. saponis co., five or ten grains. A free purgation, and subsequently gentle action of the bowels, with antimonial salines and low diet, constitute the remainder of the treatment. In *gouty* cases, the acid and irritant state of the urine should be neutralized by alkaline diluent drinks, as in acute cystitis. *Retention* of urine may yield under a full dose of opium, or necessitate the occasional use of the gum-elastic catheter. By promptly adopting these measures, the inflammation may subside, without suppuration; although there is always a liability to relapse, the prostate remaining tender, enlarged, and hardened for some time, with some difficulty or delay in the passage of the stream of urine.

Abscess of Prostate.—Suppuration is preceded by throbbing about the neck of the bladder or in the perineum; the *rectal swelling* becomes *softer*, and *tense fluctuation* may be perceptible; *pus* appears in the urine, when the abscess bursts into the *urethra* and discharges through that passage. Generally, the urethral opening soon closes; if it remains open it becomes a receptacle for urine, and induces *abscess* in the *perineum*, which bursting externally, forms a *fistula in perineo*. Sometimes, the abscess opens through the rectum, resulting in the establishment of urethro-rectal fistula; and occasionally it opens into the bladder, or backward into the peritoneal pouch. Not unfrequently, the abscess is burst by the introduction of a catheter, in relieving the retention of urine caused by the enlarged gland; the matter being drawn off through the instrument. The quantity discharged may be considerable. All the agony of prostatitis, culminating in abscess, at once ceases; the sleepless and bewildered patient sometimes falling exhausted into a slumber.

Peri-prostatic abscess occurs in not a few cases; the matter forming external to the prostate, and not within the capsule of the organ. It may be distinguished by *oedematous swelling*, diffused around the prostate, instead of the tense fluctuation and usually more limited and circumscribed collection of matter within the substance of the gland. Such abscess is of less serious import than prostatic abscess.

TREATMENT should be prompt and decided with the view of giving vent to any formation of matter. When, therefore, there is a tendency to perineal pointing, as indicated by brawny induration, without any fluctuation, an *incision* should at once be made in the *middle line*, about three-quarters of an inch anterior to the anus, and down to the matter; taking care to avoid the rectum. With this view, the forefinger of the

left hand should be passed into the bowel; a long, straight, and narrow, sharp-pointed bistoury used, and the edge be directed upwards. The depth to which the incision must be carried will be an inch and a half to two inches, and it is extended straight upwards in the raphe just sufficiently to give a fair patulous aperture. Relief is immediate. If no pus makes its appearance, the relief of tension and pain will be effected, and the matter may escape through the wound after poulticing for a few hours. Thus, then, communication with the urethra or rectum is prevented. *Puncture* through the rectum has been made occasionally, when fluctuation was distinctly felt in that situation. When the abscess has burst into the urethra, it will be desirable to draw off the urine, from time to time, by a well-curved gum-elastic catheter, or even to keep the bladder empty by retaining the instrument, if it can be tolerated; thus to prevent any accumulation of urine in the cavity of the abscess, which would be a source of continued suppuration. In passing the catheter, its point should be directed along the roof of the urethra, when the turn is made under the pubic arch; thus to avoid slipping into the cavity of the abscess.

Peri-prostatic abscess must be treated in like manner, there being no practical distinction between it and prostatic abscess.

Chronic Inflammation results in enlargement of the prostate; which is accompanied with frequent and painful micturition, but a less forcible propulsion of urine than natural, followed perhaps by a drop or two of blood; usually also there is a clear and transparent gleety discharge, or a viscid muco-purulent matter oozes from the meatus, and the urine is milky and deposits more or less purulent matter on standing. This discharge from the urethra is significant of *prostatorrhœa*,—when it is accompanied with the other symptoms of chronic prostatitis. The discharge of viscid mucus appears especially after micturition, and is increased by straining defæcation. Pain in the passage of hardened feces, and in sexual intercourse, and nocturnal emissions, are often experienced. These symptoms are much increased by riding on horseback or prolonged walking exercise, and by errors of diet. The patient is often subject to great mental depression and despondency. Examination with the finger *per rectum* will discover the prostatic enlargement.

The **DIAGNOSIS** of *prostatorrhœa* from (1) *gonorrhœa* turns mainly on the viscid character of the discharge; and when resembling that of gleet, the fact of there having been no antecedent gonorrhœa will be distinctive. (2) From *spermatorrhœa*, the absence of spermatozoa in the discharge is characteristic of its different nature. (3) From *chronic hypertrophic enlargement* of the prostate, chronic prostatitis may be distinguished by its painful character. In passing an instrument, the hyperæsthetic or highly sensitive state of the prostatic urethra is further significant, and all the symptoms of prostatitis are much aggravated for some time afterwards. (4) *Stone* in the bladder simulates symptoms of chronic prostatic enlargement,—inflammatory or hypertrophic; frequent, and perhaps painful, micturition being attended with blood-stained urine occasionally, and pain or irritation in the glans penis, especially after the act of micturition, when the bladder contracts upon the sensitive prostate; but there is *delay* in passing water, instead of the *sudden stoppage* which sometimes occurs from a stone falling over the neck of the bladder. *Sound*ing will afford abso-

lately diagnostic evidence of a calculus; unless when the stone lies concealed behind an enlarged prostate, where it may escape detection.

TREATMENT consists in counter-irritation to the *perineum*, and careful regulation of the digestive organs in order not to provoke the prostate by constipation or acidity of the urine; coupled with the administration of iodide of potassium and tonics, especially iron and quinine. Dilute phosphoric acid, in drachm doses, with half a grain of strychnine, in solution, is highly recommended by Bumstead. These medicinal measures should be reinforced by a supporting diet. Nocturnal emissions are best overcome by the application of nitrate of silver to the prostatic urethra. By pursuing this course of treatment for a long period, a cure will generally be accomplished.

Chronic Enlargement, or Hypertrophy, of the Prostate.—This prostatic affection is of common occurrence after the age of fifty-five to sixty years; but it never happens before the first-named period, and extreme old age seems to be less liable to it. Age and this prostatic enlargement are, therefore, invariably associated; yet as an incidental pathological condition, and not a physiological change. In the majority of old men, the prostate remains of normal size; and in some, this organ actually becomes atrophied. Chronic inflammatory enlargement of the prostate may occur at any age after puberty; but the chronic enlargement of the gland in advanced life is quite distinct from any inflammatory state—it is an hypertrophied condition.

The parts of the prostate thus affected may be the two lateral lobes (Fig. 138), which are sometimes increased to four or six times their

FIG. 138.*



natural weight and bulk; or an out-growth may take place from the central part of the organ, in a backward and upward direction between the neck of the bladder, and just behind the vesical or urethral orifice; appearing as a more or less rounded or pyriform tumour of prostatic tissue—the enlarged "middle or third lobe" (see Fig. 139), or "median central hypertrophy" of the prostate, at the neck of the bladder; and this form of partial enlargement is most commonly met with. Generally, the whole organ more or less partakes in the enlargement. Isolated tumours of prostatic tissue—*myomatous* tumours—are very commonly produced, and found imbedded

within the proper structure of the gland, or projecting as out-growths—externally, or into the prostatic urethra.

SCYRROUS ATRIANGULATION IN THE PROSTATIC URETHRA, AND NECK OF THE BLADDER.—In consequence of prostatic enlargement, the prostatic urethra is elongated, and diminished transversely; the canal becoming a narrow passage, instead of being, when distended, of nearly equal diameter in both directions. In point of length this portion of the urethra some-

* In Bartholin's *Mag. Mus.* Bladder opened, and longitudinal section of enlarged prostate.

times measures four inches from the orifice of the bladder to the membranous portion, instead of its normal length, one inch and a half. With enlargement of the middle lobe—median prostatic hypertrophy—the urethra rises abruptly as an *angular curvature*, instead of having nearly a straight line; thus presenting a complete step or “bar at the neck of the bladder” (Fig. 140), over which an instrument must be made to pass before it will enter the cavity. With enlargement of either lateral lobe, in addition to that of the middle portion, the *lateral direction* of the *prostatic urethra* is also changed; curving to the left when the right lobe is enlarged, and *vice versâ* (Fig. 141). The *vesico-urethral orifice* or opening of the bladder undergoes alterations of shape; becoming crescentic, with the convexity turned upwards, when the middle lobe is enlarged; or turned to the left or right, according as the enlargement of the lobe on

FIG. 140.*



FIG. 141.*



the *opposite* side predominates; or, perhaps, by an enlargement of either *half* of the middle lobe.

Thus, then, the *urethral canal*, as a *whole*, is always *elongated* and *more curved*; while the *prostatic portion* and vesical orifice may sometimes together have also a *tortuous* course.

The *CAUSES* of chronic enlargement, or hypertrophy of the prostate, are obscure. All circumstances which tend to induce active determination of blood to the part, may aid in the development of hypertrophy. Hence, emotional excitement of a sexual kind, sexual excesses, over-stimulating food, irritant states of the urine, rectal constipation, sedentary habits, horse-exercise, exposure to cold, especially of the lower extremities, may be enumerated as accessory causes of this prostatic affection. But the *initial cause* or origin seems to be unknown.

SYMPTOMS.—Commencing insidiously, chronic enlargement of the prostate makes some perhaps considerable progress before any marked symptom supervenes. Then the symptoms manifested are:—increased

* Roy, Coll. Surg. Mus.

than enlargement of the prostate, there is the phlegm and more or less hardened state of this body, as discharging into the rectum, and feeling in the situation the neck of the bladder.

Pathology supplies the true explanation of all the enlarged prostate projects upwards in the bladder, and in the receptacle thus formed behind the prostate, emptied below the level of the prostatic eminence. On straining-down efforts are made; but the stream is slow, thin, slowly and ineffectually; the surplus is passing off, the residual urine, often in large quantity, the prostate in the bladder. Even this occasions only when the bladder is sufficiently distended to rise, and the straining compression of the abdominal the resistance offered by the enlarged prostate. An of urine takes place occasionally, from over-distension of adults. In some cases, owing to an open state of the urethra, there is a constant dribbling of urine; an in be distinguished from that of the occasional over bladder with a catheter from its inferior fundus; it immediately afterwards through an open vesical orifice after, as overflow. Attacks of complete retention from any cause of temporary prostatic congestion; or damp, sexual excitement, or some error in diet; sometimes the first occasion of discovering the enlargement. Complete retention and a distended indicated by dulness on percussion above the pubis as high as the umbilicus. The slight hæmorrhagic, persistent urethral discharge, not unfrequently happens of prostatic congestion. Profuse bleed occur from transfusing a projecting portion of the prostate, or forcibly passing a catheter.

The enlarged prostate, as felt on introducing the catheter is the most common. Usually it is that

ed with the finger, and I have noticed that pressure upwards towards vesical neck provokes the desire to micturate,—an additional symptom median central enlargement of the prostate. By tilting upwards and towards the base of the bladder, some of the residual urine can be led; and by passing a catheter through the urethra, several ounces—ten, twenty, thirty, forty, or more—may be drawn off, although act of micturition had just previously been performed. The patient, had imagined his inability to retain, is now convinced of his inability to expel his urine,—that his bladder retains too much.

RETREHAL EXPLORATION with a catheter will afford information which rectal exploration cannot convey, respecting the state of the middle-lobe, as to the elongation and curve of the urethra in its prostatic portion; completing the examination. For this purpose it is better to use, a full-sized catheter of the ordinary length and curve, as the standard for comparison; so that any alterations from the healthy condition may once made apparent. If, with no perceptible enlargement by rectal examination, the urine flows when the instrument has traversed not more than the ordinary distance—about six to eight inches—while the handle has not been more than usually depressed, there will assuredly be no prostatic enlargement. But if the catheter has passed easily *nine or ten inches* and still no urine flows, while, following its course, the *handle* has been more than usually *depressed*, there will certainly be enlargement of the prostate. Then the *prostatic catheter* should be used; a longer instrument by from two to four inches, and having a much larger curve. Increased length, and the up-curve of the prostatic canal, can be ascertained by means of this instrument; the one fact, by observing the position of the shaft introduced; the other, by its depressed position when the point enters the bladder. Any *lateral* deflection of the instrument, to the right or to the left, when allowed to take its own inclination, will more or less indicate a greater degree of enlargement on the side *towards* which the handle inclines.

The *mode* of passing a prostatic catheter will be noticed presently. Examination of the prostate, thus far, may be conducted advantageously by using the finger in the rectum and the catheter in the bladder at the same time; the concerted movements of the two instruments assisting, moreover, the thickness of the prostate, as well as the length and curve of the prostatic urethra.

Exploration of the vesical portion of the prostate,—as to the *enlargement* of the *middle lobe*, with the fossa or receptacle behind it, can be easily effected by means of a *sound* having a very short curve or only a slight bend. On passing this instrument into the bladder, the beak is then bent down, and the post-prostatic receptacle sounded as to its depth, as if for a stone,—which not unfrequently lies concealed behind an enlarged prostate; in withdrawing the beak forwards, the posterior limit of prostatic enlargement is ascertained,—a point not often ascertainable by rectal exploration; then the state of the middle lobe is determined more clearly than by the upward curve in entering the bladder. Person's catheter-sound, with fluted handle, is also a most useful instrument for this exploration; having, moreover, the advantage, that as the catheter is withdrawn, the urine may be drawn off or the bladder injected, to suit the operation.

ment reaches the prostatic urethra, and generally the instrument have disappeared. In enlarged prostate, inches of the instrument will have disappeared; obstruction; and not necessarily then, if the instrument length to enter the bladder. But the handle must the patient's legs to a much greater degree than in the difference of age in the two cases will corroborate the almost invariably appearing before middle life; present until after that period.

(2.) Stone in the bladder may be distinguished from the prostate by certain features pertaining to each. Pains in the glans penis and vesical irritability at micturition, when the bladder is empty and the stone at the most sensitive base of the bladder behind the symptoms are also then aggravated by exercise, or as the stone rolls about on that part. The stream suddenly, by the stone falling over the vesical orifice is liable to happen also when an out-growth from the prostate exists in the form of a valve, which from the neck of the bladder,—a rare form of prostatic enlargement is more common, as a symptom of calculi fluid and unmixt, is more abundant in quantity, liable to occur after exercise, by attrition of the membrane of the bladder. Sweating affords conclusion when the foreign body can be distinctly struck.

The co-existence of stone with an enlarged prostate combination—renders the diagnosis far more ambiguous. In the receptacle behind the enlarged prostate, the and vesical irritability will be less marked or absent, if the foreign body from the sensitive neck of the ureter to be washed over the vesico-urethral orifice, a passage of urine, and any indication by the sudden cessation of urine being equivocal evidence, as arising, perhaps

two out-growths will be determined principally by careful urethral tion with the beaked sound; and the diagnosis may be confirmed distressing vesical irritability, the severe pain, and the copious ng hæmorrhage; and at length, by examination of any urethral ge with the microscope, which reveals perhaps the presence of *eristic structural elements*.

From simple *atony* of the bladder, the distinction of enlarged e turns upon the twofold fact: that when a catheter is introduced e bladder, no urine, or scarcely any, flows in the recumbent position, contractile action of the bladder, nor can much be expelled by any of the patient. Atony may, however, have supervened from over- ion, as a consequence of prostatic enlargement.

) In *paralysis* of the bladder, when a catheter is introduced, urine only in the same small, slow stream as in atony; but there is ty on the part of the patient to propel the urine by any voluntary of the abdominal muscles, this inability being of course propor- to the completeness of the paralysis. The lower extremities also most always involved, and this paralytic condition results from or disease of the nervous centres,—brain or spinal cord. The e of any prostatic enlargement should not be overlooked.

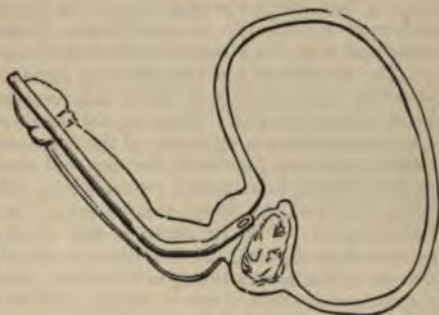
SEQUENCES.—1. *Chronic cystitis*, or a state of the bladder border- it, commonly ensues from the habitual retention of urine, and sion of the bladder, which passes ultimately into a state of atony.

the characters of the *urine*, in chronic enlargement of the prostate, ch as depend on decomposition of some of its constituents, from ion, mixed with the products of chronic inflammation of the vesical s membrane. The interior of the bladder changes in colour to a h slate hue, as seen after death; and viscid mucus or purulent e, streaked with whitish phosphatic deposit, and occasionally tinged lood, is voided in the urine; which is alkaline, and of a pungent nial or fetid odour. Perhaps a deposit of urates and uric acid place, in connection with a gouty diathesis. Stone is very apt to n the constantly retained residuum of urine, behind and below the ed prostate. Deposition of the urinary constituents occurs probably t some inspissated mucus, as a nucleus; and the calculus is more phosphatic, or perhaps as encrusting urate of ammonia. The ty of urine passed varies much from day to day; the measure being dly much above, although sometimes below, the average healthy rd. The patient's *general health* declines during the course of his al retention, and inflammatory affection of the bladder. As the of broken rest, from ineffectually relieving the bladder, and exhaus- duced by chronic cystitis, he becomes sallow and dejected, he loses and strength, and "ages" fast. Occasional attacks of complete ion throw him further back. 2. A *gradual decline* of health takes or *rapid depression* may occur, from ulceration or sloughing of the er, with repeated hæmorrhage, or from profuse purulent discharge. *æmia*, from suppression of urine, sometimes closes the scene.

REATMENT.—Palliative measures alone have any effect in chronic ement of the prostate, this hypertrophy, naturally incident to ad- g years, being incurable. The Surgeon must have in view the of retention by catheterism or other operative interference, the

enlargement of the prostate, an instrument of varying resistance will be more suitable for the passage. As a rule, it will be unnecessary and undesirable to allow the catheter to remain in the bladder; but if it be requisite to procure ease and sleep, this continued use of the instrument affords great comfort. It may be left in the bladder during the night, for example. The gum-elastic or a vulcanized india-rubber catheter is then preferable, as being less liable to irritate the mucous membrane. The bladder should be *washed* out occasionally by an injection of tepid water, to remove any muco-purulent matter and gravel, or to prevent the formation of stone from any residual decomposing urine. The patient should be taught himself to wash out the bladder,—besides learning how to pass the catheter.

FIG. 142.



When no instrument can be got into the bladder, other methods of gaining an entry may be resorted to. They are—forcible catheterism or tunnelling the prostate; puncture of the bladder through the rectum; or puncture above the pubes. The first method is justly discarded.

Cancer of the Prostate.—Cancer is met with less commonly as a secondary deposit, than as a primary disease of the prostate. The form of cancer is almost always encephaloid, and sometimes it is associated with melanotic deposit; scirrhus seems to be of doubtful occurrence.

Age has apparently a certain relation to malignant prostatic disease; it has been observed only in childhood and advancing age.

The **SYMPTOMS** are those of prostatic enlargement; but distinguished by the *severity* of the *pain*, and its shooting into the rectum, up to the sacrum, and down the thighs; the oft-recurring and more abundant *hæmorrhage*; and, perhaps, constitutional cachexia. The *tumour* examined through the rectum, as compared with chronic prostatic enlargement, is of *larger size*, *harder*, and perhaps of *irregular shape*; subsequently becoming *softer* and *fungating*. The adjacent *lymphatic glands* are affected, both lumbar and inguinal; confirming the diagnosis. Marked *rapidity* of the symptoms, however, distinguishes the malignant disease; its duration from first to last extending not longer than from one and a half to five years in adults, and from three to nine months only in children. Sometimes, the co-existence of cancer in the testicle begets suspicion in even an early stage of prostatic cancer, which may be a secondary affection to the disease in that organ, or in the kidney.

The **TREATMENT** is palliative. Catheterism should be avoided if possible, and then performed with the gentlest touch, not to irritate or injure the painful and bleeding prostate. *Supra-pubic cystotomy* would here seem to be advisable, not only for the relief of retention, but to

establish a permanent diversion of the urine from the diseased prostate. Stagnation in the form of opium or opium may be substituted both by mouth and rectum. Hemorrhage must be treated as explained in connection with hematuria. The general health and strength will require all the support which can be given by tonic and a nutritious diet.

Tubercle.—The prostate is very rarely the seat of tubercular deposit, and then always as a secondary affection; some other part of the genito-urinary tract being the primary seat of deposit. The kidney marks first, and next the vesicle or epididymis. Phthisis pulmonalis is generally associated with the tubercular affection of any genito-urinary organ.

The Stricture is frequent and painful micturition, with some obstruction to the passage of urine, and occasionally slight hemorrhage—as in chronic prostaticitis. There is also some amount of prostatic enlargement, and perhaps irregularity of the organ, ascertainable by rectal examination; the vas deferentia and seminal vesicles are also sometimes felt to be enlarged, knotty, and indurated by the deposit—when, these parts being involved, the finger can be passed beyond the enlarged prostate. Subsequently, with suppuration and discharge, the prostate becomes smaller than natural, and the urine purulent. The tubercular prostate always is obstinately indisposed to close. Otherwise, the absence of any special symptoms, and the co-existence of at least a phthisical tendency, will indicate the nature of this disease, throughout its slowly progressive course.

Commonly terminating fatally from exhaustion, or from pulmonary phthisis, the patient may at length recover, under favourable hygienic circumstances.

Treatment must be conducted on general principles, in regard to the constitutional disease.

Prostatic Calculus.—The prostate gland, like other glands, is liable to an impaction of its secretion, forming nuclei, around which inorganic deposit and accretion takes place, in concentric layers, within the ducts of the follicular structure. This mode of origin and situation is characteristic of true prostatic calculus, and distinguish it from urinary calculus which may have lodged in the prostate. Prostatic calculus is composed principally of phosphate of lime, about eighty-four per cent., with a trace of carbonate of lime; organic matter, fifteen per cent., constituting the remainder.

The Strictures to which prostatic calculi give rise, depend principally on their size. When small, there may be no symptoms, or such slight inconvenience as not to attract attention. When of larger size, they are attended with pain and weight in the perineum, and uneasiness at the neck of the bladder; there is frequent micturition, sometimes retention, and difficulty in the emission of semen, although attacks of priapism may have induced the sufferer to more frequent sexual intercourse. All these symptoms point to an enlarged and irritated prostate; and by urethral or rectal exploration, one or more stones can be touched with an instrument, or felt through the prostate with the finger. On passing a sound through the urethra, a distinct click or *grating* is heard and felt, just before the beak of the instrument enters the bladder; a deeply embedded calculus may be felt, on passing the finger up the rectum, or by simultaneous examination with the finger and sound. A large number of

small stones communicate to the finger a *crackling* or grating sensation, like that of small marbles in a bag. Commencing with microscopic size after puberty, these prostatic concretions are found chiefly in patients of middle age or advanced life.

TREATMENT.—When there are no urgent symptoms, the case may be wisely left alone, so far as regards any attempts to remove the stone by operative interference. Symptoms of irritation can perhaps be subdued by opiate suppositories, and careful regulation of the bowels to prevent any rectal constipation; while retention of urine is relieved by using the catheter as occasion requires. If the calculi are small and movable, they may admit of extraction through the urethra, by means of a long urethral forceps. But this mode of operation is not easily accomplished. When the stones are large, and not more than two or three in number, *median* lithotomy should be performed, and extraction effected with scoop or forceps. A larger-sized calculus had better be removed by the *lateral* operation. In either procedure, it will be necessary to completely remove the whole formation, by washing out the prostate and bladder; any bit remaining would be the nucleus of fresh concretion.

Sometimes the Surgeon has to deal with a urinary calculus or fragment, lodged in the *prostatic urethra*. Here the urethral forceps can more often be employed with advantage; or failing thus to remove the stone, it may be pushed back into the bladder, and submitted to lithotritry or lithotomy.

Lastly, the occasional *co-existence* of prostatic and vesical calculus presents a difficulty in the way of the lateral operation. Yet, under these circumstances, this mode of removing both calculi may alone be practicable.

CHAPTER LIV.

DISEASES OF THE URETHRA.

THESE diseases have been incidentally alluded to, as associated with vesical and prostatic affections, and may be thus enumerated:—(1) Inflammation of the Urethra, or Urethritis, and its more specific form, Gonorrhœa; (2) Stricture or contraction of the canal, in some part or parts of its extent,—as a structural or organic and permanent condition, or as a spasmodic, or an inflammatory state; (3) Urethral Calculus. The results of Urethral obstruction comprise—Retention of Urine; Extravasation; Rupture of the Bladder; and Urinary Fistulæ,—penile, scrotal, perineal, urethro-vaginal, and vesico-vaginal fistulæ.

Urethritis.—*Simple* inflammation of the urethral mucous membrane may arise from various causes, at any age, and in either sex. Any one who may be thus affected experiences heat, pricking, and tension in the urethra for a day or two, with some smarting or perhaps scalding sensation in passing water; symptoms which are followed by a muco-purulent

the occasions of urethral irritation
fragment of stone or other foreign
intercourse or excitement, the intro-
as the menstrual fluid, or leucorrhœa.
Simple urethritis generally sul-
gonorrhœa, which continues some
charge often becomes chronic in
stricture.

TREATMENT consists in removing
allaying the inflammatory symptoms
case, both these indications may be
alkaline, saline aperients, combined
a moderate and non-stimulating diet
passive, weak astringent injections,
sulphate of zinc, will gradually arrest
the cure.

Gonorrhœa or Blennorrhœa
with muco-purulent discharge, of a
produced by contagion or contact with
sexual intercourse. It may affect, an

The SYMPTOMS of gonorrhœa differ
which may thus be divided into four
mening generally from the second
short period of urethral irritation in
which subsides into a declining or
in gleet, a chronic state of peculiar
supervene.

1. *Urethral irritation* is attended
itching or tickling sensation in the me-
puffed appearance, and are glued together
colourless, or slightly opalescent secretion
smarting is experienced, but no scald
lasts from a few hours to two or three days.

2. *Acute inflammation*

glans penis is turgid and of a bright cherry-red colour; the urethral canal is swollen and cord-like to the touch; the prepuce may become œdematous, and at length the whole penis looks and feels turgescient. Should the inflammation pass back to the bulbous urethra, a sensation of weight in the perinæum will be experienced, and, reaching the prostatic urethra, a bearing-down weight about the anus is superadded.

The average duration of this stage is from *one to three weeks*; its continuance varying according to the number of previous attacks and the habits of the patient.

3. The *chronic* stage is denoted by the altered character of the urethral discharge; the pus subsides into muco-purulent matter, which is *thinner* and less *copious*; and the scalding reverts to smarting or only a *soreness* in micturition. In about three weeks, the gonorrhœa may pass off,—under treatment; but it rarely terminates spontaneously in less than *three months*. During a severe and protracted gonorrhœal discharge, the general health undergoes a marked depression; so that the individual may be almost known by his haggard, *pallid*, and listless appearance.

4. *Gleet*.—Blenorrhœa or gleet must be regarded as the sequel, rather than the concluding stage, of gonorrhœa; for it does not invariably result. The urethral discharge has now become a *thin*, nearly *clear* and *colourless*, or almost watery fluid, oozing in small quantity, or so *scanty* that it has to be pressed out of the meatus for examination; *no scalding* or other inflammatory symptoms remain; yet this discharge is persistent—lasting for many *months* or even *years*. It may be maintained by certain constitutional conditions; a scrofulous, rheumatic, or gouty diathesis; a lymphatic, weakly temperament; or simply by a state of debility. The indulgence in alcoholic stimulants, or in sexual intercourse, or the combination of both sources of urethral excitement in a dissipated life, is equally provocative of continued gleet. The discharge retains its *contagious* nature for a long or indefinite period; and it is ever liable to be developed into a more virulent puriform secretion by slight exciting causes. Sexual intercourse, therefore, is always unsafe, so long as any discharge exists, of whatever kind, or in the smallest oozing of secretion.

DIAGNOSIS OF GONORRHOEA FROM SIMPLE URETHRITIS.—No positive distinction can be trusted from the appearance of a urethral discharge, its contagious character, or from its having been produced by contagion. As Ricord truly observes, "Gonorrhœa often arises from intercourse with women who themselves have not the disease;" and, yet more explicitly, Diday affirms "that from the very fact of a woman having a discharge, no matter what its origin, she is liable to give a discharge to a man." Bumstead bears similar testimony as to the possibly *non-specific* origin of gonorrhœa in a man from an uncontaminated woman. In the male 'sex also, *any persistent* urethral discharge—whether from gonorrhœa, as gleet, or of non-specific nature—may equally prove contagious to a woman.

The following additional practical facts, although not perhaps exclusively characteristic of *gonorrhœal* contagion, appear to be well established:—(1.) The disease is not communicated by sexual intercourse *before* the discharge appears. (2.) Mere *contact* is sufficient, without any abrasion of the urethral mucous membrane. And contact alone, without any sexual act, may effect contagion. (Baumés, Rodet.) (3.) After the dis-

discharge is established, if the urethra be previously washed out by means of a weak injection, the disease will probably not be communicated. (4.) The infectious element in the secretion is alone the contagium, the mucus thus being inoperative. (Salter.) Hence, the more puriform the discharge, the more dangerous is it. (5.) The matter retains the power of infection in an indefinite period: in one case Tully found that a girl had communicated the disease immediately on leaving the Magdalen Hospital, after a secretion of one year; and in another case, according to Hunter, after two years' secretion. (6.) With gleet, two persons thus affected may have intercourse with impunity; but either of them will communicate gonorrhoea to a third person. (7.) The violence of the symptoms depends very much on constitutional conditions, as the gouty diathesis, and habits of life as intemperance; consequently, the same wound may give a very mild gonorrhoea to one man, and a most severe to another. (8.) The first attack of the disease is generally the most severe, a kind of urethral aneurism—the accumulation of Ricord—being sometimes induced by repeated attacks. (9.) The severity and the continuance of gonorrhoea are often severe: it is most severe in young and robust persons, in the purgic or rheumatic diathesis, and in the first attack. As men acquire a scrofulous and phlegmatic constitution, in persons affected with chronic skin-disease, and after repeated attacks. (10.) The disease seems to be much milder now than formerly.

CHARACTERISTICS.—An ordinary case of gonorrhoea passes through an inflammatory stage, and the discharge runs itself out. But several cases are attended with the formation of a suppurating part, may terminate in the formation of the disease. 1. *Urethritis*, a local and painful inflammation of the urethra. Sometimes instead of the corpus being inflamed, the urethra is inflamed, the corpus remaining unaffected. The inflammation of the urethra during erection, is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 2. The inflammation of the urethra is attended with a discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 3. In the inflammation of the urethra, the discharge is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 4. In the inflammation of the urethra, the discharge is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 5. In the inflammation of the urethra, the discharge is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 6. In the inflammation of the urethra, the discharge is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 7. In the inflammation of the urethra, the discharge is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 8. In the inflammation of the urethra, the discharge is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 9. In the inflammation of the urethra, the discharge is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge. 10. In the inflammation of the urethra, the discharge is attended with a constant discharge of the purulent matter in the stream of urine, and is attended with a discharge of mucus upward, or backward, or both ways, which is attended with a constant discharge.

by early or strong urethral injections, intemperance, or the use of copaiba in large doses. 6. Inflammation of the *inguinal lymphatic glands*, or *sympathetic bubo*, occurs during the second or inflammatory stage of gonorrhœa. But such buboes rarely proceed to suppuration, unless when subjected to irritation, or in persons of a scrofulous and debilitated constitution. 7. *Balanitis*—an inflammatory affection of the mucous membrane of the prepuce and glans—is known by a thin, opalescent discharge from this part, often profuse and excoriative. Persons who have a long prepuce are most liable to it; but it is engendered by uncleanness, hot weather, or disordered health. 8. As the result of swelling of the prepuce and glans, *phimosis* or *paraphimosis* is not unfrequently met with in conjunction with gonorrhœa. Thus, the prepuce cannot be retracted, or not easily, behind the glans, so as to uncover it; or the prepuce cannot be drawn forwards from behind the glans, so as to cover that part of the penis. 9. Various cutaneous eruptions on the prepuce are occasionally concomitants of gonorrhœa. *Herpes præputialis* appears in the form of small vesicles, containing a thin, opalescent fluid; and which are disposed in clusters of two, three, or four, upon the internal or external surface of the preputial fold. Roseola, pityriasis, and psoriasis sometimes make their appearance; usually from six weeks to three months after the commencement of gonorrhœal discharge.

CONSEQUENCES.—A patient having escaped any mishap in the course of gonorrhœa, is yet liable to the *consequences* of this urethritis. 1. *Orchitis*, or inflammation of the testicle, is not uncommon; commencing as epididymitis, and resulting in a swollen state of the organ. This occurs at a period from the third to the eighth week. The inflammation terminates in resolution, seldom in abscess. Both testes are often affected, but rarely at the same time; and there is a liability to relapse. One attack predisposes to another from the slightest urethritis. 2. Gonorrhœal *rheumatism*—whether in the form of synovitis, or as affecting the fibrous textures. 3. Gonorrhœal *ophthalmia*, an acute purulent inflammation of the conjunctiva, may occur in consequence of the accidental application of the urethral discharge to the eye,—an inoculation of gonorrhœal matter to another mucous membrane. This mode of origin does not seem to be always indisputable; for both eyes are often affected, and usually at an interval of a few days, the eye attacked last generally suffering least. Gonorrhœal *scleritis*, an inflammatory infection of the sclerotic or fibrous coat of the eye, may be of a rheumatic character. 4. Occasionally, gonorrhœa or gleet is followed by *prostatorrhœa*, a chronic inflammation of the prostate gland; characterized by the discharge of a few drops of clear, transparent, or slightly turbid, viscid mucus, after micturition or any straining effort of defæcation. This fluid is not semen, as it contains no spermatozoa. There is also much irritability about the neck of the bladder, and sensitiveness of the prostatic urethra in passing an instrument; with loss of strength, and mental languor or hypochondriacal lowness of spirits. 5. *Stricture* of the urethra, one of the most ordinary consequences of gonorrhœa, is considered in connection with the general pathology of this disease.

TREATMENT.—The *treatment* of Gonorrhœa varies according to the stage of the disease.

1. During the incipient stage—*urethral irritation* of, say, forty-eight

hours' duration—it may be possible to prevent the accession of the inflammatory stage, by means of "abortive" or "revulsive" treatment, which comprises astringent urethral injections, and the specific influence of copaiba or cubebs. But any such agents, if used for that purpose, are very hazardous, by perchance exciting intense inflammation. So far as opportunity may offer for this practice, I believe it is generally abandoned.

2. *Inflammatory stage—acute and chronic.*—From the commencement of a gonorrhoeal purulent discharge, reducing measures, followed by suppressive injections, may be employed,—according to the degree of urethral inflammation. When *acute*,—with an abundant, thick, opaque yellow, or creamy discharge, and scalding in passing urine,—the appropriate treatment consists in gentle saline, alkaline, aperient medicine, an unstimulating diet, abstinence from wine, beer, or spirits, with rest and recumbency. As a topical application, immersion of the penis in very hot water, for a few minutes, is said to afford great relief; and Fournier recommends a similar application of cold water. When the inflammation has passed into the *chronic* stage,—with a diminished, thinner, and clearer discharge, and the absence of scalding in micturition,—the previously reducing measures should be discontinued, and succeeded by acid tonics; or perhaps copaiba or cubebs, and astringent urethral injections, may be used. In *gleet*—the discharge having now become scanty, thin, clear, and colourless, as a watery oozing from the urethra, and lasting for a considerable period—the same suppressive measures will also be appropriate.

Injections.—The discharge may be *safely* suppressed, gradually, by using an injection twice a day; consisting of about ʒij. of the liquor plumbi diacetatis to ʒij. of distilled water. Other injections, if not more efficacious, may be preferred. Thus, sulphate of zinc, gr. i., gradually increased to grs. iv., to ʒj.; or sulphate of zinc and acetate of lead, ana grs. xxx. to ʒvj., an injection long in use at the old Lock Hospital. In obstinate *gleet*, the bichloride of mercury may prove successful, gr. ʒ to ʒi. of water; other formulæ also are in use: sulphate of copper, gr. i. to ʒi.; or that which Bumstead recommends,—the persulphate of iron, ʒss. to ʒvi. of water. Before using any injection, the patient had better pass his urine, in order to clear the urethra of gonorrhoeal matter, which would prevent contact with the mucous membrane; and also to avoid the necessity of emptying the bladder again for some time, care being taken to drain away any urine from the urethral canal. No injection should cause pain, but only a feeling of warmth or smarting, and which ceases in a few minutes.

The *medicinal* treatment of chronic suppurative discharge, and of watery gleet, is best fulfilled by an acid- tonic mixture of cinchona with sulphuric acid; but towards the close of the case, the perchloride or the sulphate of iron should be given, to repair the anæmic condition. Such treatment as may be suitable in the various other *constitutional* conditions, must not be overlooked; as in the scrofulous, rheumatic, or gouty diathesis, on which a gleety discharge may depend.

Chordee is best prevented or overcome by a nightly pill of opium and camphor,—say, one or two grains, as an anodyne antispasmodic; or conium and camphor, in pill, I have often ordered with marked relief. Or Ricord's suppository—of opium, the watery extract, one grain, with

camphor ten grains—may be introduced into the rectum an hour before bedtime. The patient must deny himself supper or any excitement before going to bed, and then bathe the parts with cold water, or preferably with hot water until a sensation of faintness is produced; he should lie on a hard mattress, and be lightly covered with bed-clothes. If the sufferer from chordee be tempted to forcibly straighten the penis—"to break the chordee"—he will indeed obtain immediate relief, but at the expense of a traumatic stricture in consequence; and of which, therefore, he should be warned.

Other *complications* should be treated according to the directions given under their respective headings, in other portions of this "Surgery."

Gonorrhœa in the Female is a much less common affection than in the male sex. But the inflammation with discharge is rarely restricted to the urethra; the *vagina* is the chief seat of gonorrhœa.

The **SYMPTOMS** are heat and itching in the vagina, with smarting or scalding in the urethra when the urine is passed; on examination, the vaginal passage is found to be red and swollen; these early symptoms being soon followed by a copious, greenish-yellow, muco-purulent discharge, proceeding more especially from the upper wall of the vagina. The *labia* usually become involved, appearing red and puffed, while the secretion from the sebaceous follicles gives an offensive character to the discharge. Sometimes the inflammation extends backwards to the *os uteri*, which presents small patches of superficial ulceration, accompanied with discharge from the cervix. Thus, the gonorrhœal inflammation affects an extensive tract of mucous membrane, in the form of vaginitis and vulvitis, with urethritis; while the perineal and anal integument has often a reddish, excoriated appearance from the irritant nature of the discharge. But all the symptoms are usually milder than in the male; and although perhaps of longer duration, the discharge does not generally pass into gleet.

Simple vaginitis must not be mistaken for gonorrhœa; and yet their *diagnosis* cannot be determined by any one symptom, or by the combination of symptoms, nor by the appearance of the discharge or its inspection with the microscope. This absence of any distinctive evidence is a very important consideration, in relation to medico-legal inquiry respecting supposed gonorrhœa in young females and children, who are very liable to simple inflammation of the vagina from various causes, both constitutional and local. The diagnosis is scarcely less doubtful with regard to vaginal *uterine* discharges, at any period of life.

Fewer untoward events are likely to *complicate* the course of the disease in women than in men. Not unfrequently one of the swollen labia suppurates, the abscess pointing on the inner side. There may be some inguinal sympathetic *bubo*, but perhaps only in cases where the urethra is affected; and sometimes the vaginal inflammation creeps up into the cavity of the *uterus*, and may even pass up the fallopian tubes to the *ovaries*; the ovaritis thus induced corresponding to epididymitis in the male. Gonorrhœal rheumatism is a rare occurrence, and gonorrhœal ophthalmia is seldom met with.

TREATMENT may be comprised in a few words. 1. During the *inflammatory stage*, saline, alkaline aperients should be given, and an unstimulating diet enjoined, with rest and recumbency. The pain and

swelling may be induced by warm, anodyne fomentations; or cold, sedative applications may be preferable. Thus, flannels steeped in decoction of poppy heads, or weak lead lotion, afford relief; and similar injections will allay the vaginal inflammation. 2. In the chronic stage, no special remedial measures are requisite, but the topical applications must be made directly to the part affected. Thus, injections must be drawn up the vagina so as to reach the seat of inflammation, and lotions should be applied by means of a fold of lint placed well in between the labia. Plugging the vagina with lint dipped in lotion, will often prove more efficacious than injection; partly by separating and insulating the diseased portions of the mucous walls. This dressing must be reapplied night and morning. 3. Urethral gonorrhoea may be treated by exposing the or with a speculum; then, having wiped away the discharge with a piece of sponge introduced by long forceps, the mucous membrane of the or and cervix should be cauterized or lightly pencilled with nitrate of silver. Speculum, as of aspalta or cubeta, can be of no service in the gonorrhoea of women, unless the urethra be affected; these medicines acting through the urine. (Of astringents, I prefer the diacetate of lead to the sulphate of zinc, alum, or other solutions; ordering the former in the proportion of an ounce or more of the liquor plumbi to a pint of water, to be injected with a rose-tipped syringe, two or three times a day. Nitrate of silver, two or three grains to the ounce, was recommended by Carnichael and Rossi.

Stricture of the Urethra.—Among diseases of the Urethra, Stricture justly ranks high in its importance; whether on account of its frequency, the distress it occasions, its serious and fatal consequences when neglected, or the unquestionable means for cure or relief.

The term Stricture of the Urethra signifies an unnatural narrowing or contraction of this passage, at one or more points in its extent. This may depend on either of three distinct conditions:—(1) Lymph-deposit in the mucous and submucous tissues, as the result of chronic inflammation,—and thence known as Organic or Permanent Stricture; (2) Spasmodic contraction of the muscular fibres encircling the mucous membrane,—Spasmodic Stricture; (3) Inflammatory congestion of the mucous membrane,—Inflammatory Stricture. The two latter conditions of stricture—spasm and inflammation—often co-exist; and either may be cured for a time on organic stricture.

Organic or Permanent Stricture.—Four forms of organic stricture of the urethra may be recognized:—*linear stricture*, in which the urethral canal is obstructed by a thin, membranous septum, having a central aperture; or a *crescentic septum*, which abstracts a segment only of the calibre of the canal; thus forming the “*bridle stricture*”;—*annular stricture*, a thicker and broader, contracted portion of the urethral canal, as if a piece of cord had been tied around it at one point, leaving the remainder free;—*indurated annular stricture*, a more confirmed contraction, in which the induration involves the tissues of the urethra to the depth of half a line or a line, limited in length from before backwards to less than half an inch of the canal, and forms an hour-glass contraction, usually thicker on the floor than at the upper aspect of the urethra;—*botryoid or irregular stricture*, owing apparently to adhesion of the rugae of the urethra to a short extent, or to a cicatricial patch of induration, or

a longitudinal contraction and induration to an extent of one or more inches. In this condition of stricture, the induration may involve the entire substance of the corpus spongiosum, presenting the most obstinate and undilatable form of stricture.

SITUATIONS OF STRICTURE.—The urethral canal is liable to stricture in three situations:—(1.) At the junction of the spongy and membranous portions, or within an inch before, and three-quarters of an inch behind, that point. Of these situations, the most common seat of stricture is the bulbous part of the spongy portion, or in the membranous portion—anterior to the triangular ligament, rarely behind; and most rarely as far back as the posterior part of the membranous portion. No instance has been found of stricture of the prostatic portion of the urethra. The above strictures correspond to the subpubic curvature.

(2.) In the centre of the spongy portion, or that portion of the urethra which extends from the anterior limit of the preceding to within two inches and a half of the external meatus, a length of about three inches.

(3.) At the external orifice, and within a distance of two inches and a half of it.

Several strictures may co-exist in the same urethra; three, or at the most four.

SYMPTOMS.—The urethral obstruction occasioned by stricture gives rise to symptoms which are individually, or collectively, significant of this condition. 1. Increased *frequency of micturition* arises, owing to the inability to completely empty the bladder; the *stream of urine* becomes smaller than is natural to the individual, and altered in form, being either flattened, twisted or corkscrewed, forked, or turned aside; and discharged with a *less forcible propulsion*, so that the current is not ejected as far from the person as formerly, and at length issues as a mere dribbling or in drops. When consequent, usually, on gonorrhœa, some such symptoms of stricture generally occur within a year of the attack; but, when resulting from injury to the urethra, the symptoms commence at an earlier period—about four months.

2. As the obstruction *increases*, after each act of *micturition* is apparently completed, another significant symptom is experienced; a certain portion of urine still escapes as a *dribbling* leakage, owing to the propulsive force of the remaining urine being insufficient to overcome the resistance of the stricture, which was dilated by the stream passing when the bladder was full. After the act of micturition is actually quite finished, a certain portion of urine can sometimes be squeezed out by pressure behind the seat of stricture, from the dilatation of the urethra in that situation. Pain is usually felt in the canal behind the stricture, during the effort to pass urine; and by constant straining, some feculent matter or flatus escapes at such times, and a tendency to prolapsus of the bowel is established. 3. In a paroxysm of straining effort, *rupture* of the urethra may occur, behind the stricture; and then extravasation of the urine takes place into the cellular texture of the perinaeum, scrotum, and supra-pubic region. In the act of *coitus*, much pain is experienced about the ejaculatory ducts, and, as the semen escapes with difficulty through the urethra but passes back into the bladder, there may be no seminal emission; and the unhappy patient believes himself actually, as he may be virtually, impotent. The

urine undergoes those changes which result from chronic cystitis, consequent on retention. It becomes ammoniacal, cloudy, and deposits more or less mucus and pus, with phosphates. Hematuria is an occasional concomitant of stricture; the blood coming from the mucous membrane of the bladder, or perhaps from the urethra after catheterism or an erection of the penis affecting the seat of stricture. A *gleety discharge* not unfrequently attends old stricture of the urethra. 4. The *genital organs* are affected by the more or less constant retention of urine. Congestion of the penis occurring from straining micturition, the organ becomes enlarged and somewhat indurated, and sometimes the prepuce is oedematous. From irritation of the prostatic urethra, epididymitis not unfrequently occurs, perhaps on both sides, resulting in knotty induration of the part; and the canal sometimes becoming obstructed with deposit, sterility ensues. In elderly men, attacks of prostatic congestion aggravate the retention; and may at length give rise to inflammation and prostatic abscess.

5. The *general health* fails, the patient losing flesh and strength: he has an anxious and careworn appearance; suffers from pains in the loins, lower part of the belly, the perineum, and testicles; and is subject to severe attacks of *rigors*. Any irritation of the urethra, as by passing an instrument or the application of an irritant substance, will often provoke such an attack, especially in those who have lived in hot climates; or it not uncommonly excites general feverishness—hence named “*urethral fever*,” and which has sometimes an intermittent character.

VARIETIES of organic stricture may be recognized by some peculiarity of their respective symptoms:—

Simple stricture; chiefly denoted by diminution in the size of the stream of urine, with the other ordinary symptoms of stricture.

Sensitive or irritable stricture.—Proneness to disturbance of the nervous system, as manifested by chilliness or rigors on very slight urethral irritation; and pain, sometimes persistent, from the gentlest passage of an instrument. A disposition to hæmorrhage is evinced in a few cases.

Contractile, resilient, or recurring stricture—distinguished by a constant tendency to further diminution of the urethral canal in the absence of treatment; and contraction recurs rapidly after dilatation has been effected. Traumatic stricture often has this character, and the same condition may result from the use of strong injections.

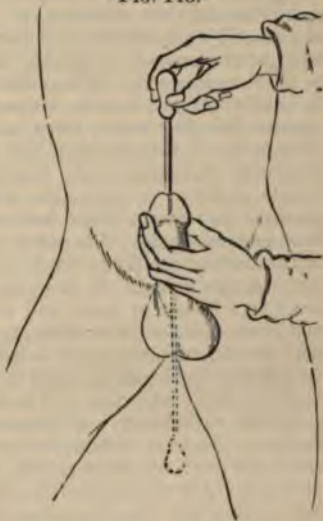
EXAMINATION OF THE URETHRA.—Catheterism, or what I would term, *bougieism*—the use of a bougie—supplies the most direct and conclusive evidence as to the existence of stricture; evidence analogous to that of sounding for stone in the bladder. The *presence* of stricture, its *situation*, its *calibre*, the *extent* of the canal involved, and the amount of *induration*, may be thus severally determined; and whether also there be one or more strictures.

Instruments of various composition and form are used for this purpose: *catheters*, which may be inflexible, as the ordinary silver instrument, or flexible, as gum-catheters; and *bougies*, which are solid instruments of flexible metal, or flexible and more or less elastic, as the ordinary gum-elastic bougie, wax or catgut bougies; the bulbous end of the elastic

beter, or bougie *oliveaire*, rendering this form of instrument the safest and most effectual for penetrating a stricture; *sounds*—probe-pointed, are employed, which being inflexible, solid metallic instruments, are longer than a metal catheter of any small size. Catheters may be curved straight. The former shape is generally applicable; and the curve most commonly suitable is that which corresponds most nearly with the bend of the urethra at its inner third—an arch rather less than one-fourth of the circumference of a circle three inches and a quarter in diameter. Eight instruments are preferable for strictures in the ante-scutal portion of the urethra.

INTRODUCTION OF A CATHETER.—The patient lying on his back, with his shoulders a little raised, the legs thrown easily apart and slightly bent, an instrument of appropriate size—No. 7 or 8—is selected, and lubricated by a little friction up the urethra for a few seconds, and then lubricated or smeared with lard. In introducing it, the handle should be held firmly between the thumb and the index and middle fingers of the right hand, the concavity of the curve looking upwards towards the left groin of the patient, and the direction of the instrument being nearly horizontal (Fig. 143). Raising the end of the instrument with the thumb and finger of the left hand, so as to draw it up to its full length, the double curve of the urethral canal, somewhat resembling an italic *s*, is thus changed into one curve, commencing from just in front of the scrotum; and this single curve corresponds to the curve of the instrument, and it passes along the urethra from the point downwards and upwards into the bladder. The point of the instrument—held as directed—is now inserted into the urethral meatus.

FIG. 143.*



carried slowly onwards along the *upper surface* or roof of the canal, avoiding the lacunæ on its floor, until four or five inches have disappeared; the handle is brought, at the same time, to the middle line, but still parallel near to the patient's abdomen; then it should be gently raised, and, the point of the instrument passes under the subpubic curve, the handle carried forwards and lightly *depressed* until it sinks below the horizontal line, when the opposite end will turn upwards into the bladder (Fig. 144). After the point of the instrument has passed below the scrotum, its further progress in the right direction may be facilitated or maintained by holding it *between the fore and middle fingers* of the left hand, under the scrotum; and sometimes the introduction of the forefinger into the rectum may aid in determining the middle line onwards to the bladder. That

* The instrument here represented is a sound, instead of a catheter.

drawn off freely, or discharged in a full stream. drawn slowly, and without force, the hand-end towards the abdomen again as the point of the subpubic arch.

In passing a catheter, any slight resistance meeting the instrument, in respect to its direction, inch or so and then repassing it. Thus the point is released when caught in a *lacuna*, or redirected by the *triangular ligament*, on passing through the narrowness in the subpubic arch. There also the grasp of the point is chiefly felt, and is to be overcome by resting the hand against the obstruction, for a minute or two. Obstruction in this situation will be noticed by the point coming from the convexity of the instrumental curve; the bougie produces no projection, when the instrument passes; but as the shaft doubles up, the urethral hand-end rebounds. The presence of *stricture* is indicated by the point of the instrument point-blank, and at the same time on each reintroduction. If, however, the point is stuck in a lacuna or some fold of the mucous membrane, it will feel loose, and should be disengaged; whereas, when it enters into the stricture, the point is felt to be *tight*—then it should be gently urged onwards. Remembering that in a stricture, this obstruction will be found usually beyond the subpubic curvature; less frequently in the anterior part of the urethra. No force should ever be used; nothing but the use of a light hand, exercised slowly, continuously and with patience. Any departure from this injunction in the use of the instrument, and the formation of a "false passage" is the more likely to happen when the hand is being depressed, whereby the shaft acts as a point in the urethral passage.

To complete the examination of any one of the instruments of different sizes, will require to be

the inflammation extending along the canal, and being of a severe or long-continued character. The symptoms of stricture supervene very slowly and insidiously; a period of many years perhaps elapsing before the existence of this organic constriction is declared. Simple urethritis may have the same result, but only under the operation of some persistent constitutional condition. *Injections* for the cure of gonorrhœa tend to the formation of stricture, when used in the inflammatory stage, or of too great strength, or long continued. Thus, an injection of nitrate of silver, one to two grains to the ounce of water, can do no harm; but in the proportion of ten grains to the ounce, it may certainly produce stricture. *Abscess* in a lacuna of the urethra, followed by contraction of the *cicatrix*, is an occasional cause; and cancerous or other ulcers may similarly result in the formation of stricture, usually near the external meatus. Amputation of the penis sometimes issues in like manner.

(2.) *Injury* to the urethra by external violence on the *perinæum*, bruising, lacerating, or rupturing the urethra, is followed by a *cicatrix*, the contraction of which is very apt to result in stricture of the most severe and intractable character. This kind of cause comprises kicks on the perinæum; falls on some hard projection, as across spars, scaffolding, ladders, chairs, saddles, gates, wheels, etc.; puncture of the perinæum, by palisading, by an earthenware vessel breaking under the sitter, etc.; laceration, by pelvic fractures involving the urethra; and lastly, by the forcible introduction of urethral instruments.

The age at which stricture of the urethra usually occurs corresponds, of course, with the period when its causes are most frequent. Gonorrhœal stricture, therefore, is most common from early manhood to middle age; but traumatic stricture may be produced more probably at any period of life.

Congenital stricture is occasionally met with, near the external meatus. In early life its existence is unattended by any inconvenience; but in adult life it gives rise to serious obstruction of the passage of urine, when the urethral tissue has become less extensible.

CONSEQUENCES.—The course of stricture is very similar to that of chronic enlargement of the prostate. 1. *Retention* of urine gradually results from the diminished calibre of the urethral canal, at the seat of stricture. 2. *Chronic* cystitis, or a state of the bladder bordering on it, commonly ensues from this habitual retention of urine and distension of the bladder. The characters of the *urine* are in accordance with that condition.

(3.) *Urinary abscess* is apt to form, from the irritation of urine in the adjoining *dilated* portion of urethra, *immediately behind* the stricture; and by opening into the canal and externally, *urinary fistula* is established.

The *symptoms* of urinary abscess—usually in the perinæum, are notable. Unusual difficulty is experienced in micturition, and increased retention of urine, therefore, distresses the patient. Some *fulness* may be felt *behind* the *scrotum*, and the part is tender; it becomes œdematous, and the scrotum may be somewhat involved; on deeper examination with the finger, induration is perceptible; this advancing to the surface, fluctuation can, at length, be detected, and the integument is overspread with a diffused redness. The abscess bursts, or is opened, and discharges an offensive mixture of pus, urine, and slough. In time, contraction

taking place, a fistulous passage remains, which presents a pointing, granular orifice,—a *fistula in perineo*; and posteriorly, the abscess communicates directly with the urethra. During the course of urinary abscess, the constitutional symptoms undergo significant changes. When forming, the abscess is attended, perhaps, with some shivering, and then with the usual febrility of deep-seated suppuration; varied only in degree by the age, and pre-existing state of the patient from stricture. But, when the abscess communicates with the urethra, the previously more or less hectic symptoms of a full, hard pulse, and hot skin, with sleepless excitement, are exchanged for typhoidal depression, a weak, rapid, and perhaps irregular pulse, while the tongue becomes dry and encrusted with a brown fur. As soon as the abscess opens, all these symptoms are relieved, and any previous retention of urine ceases.

4. *Rupture of the urethra* is liable to occur also, from dilatation of the part of the canal; followed by extravasation of urine, with its attendant symptoms. This may happen at a more or less remote period. I have known extravasation occur in traumatic stricture, twenty-six years after the injury,—a fall on the perineum across a beam; and also in stricture from gonorrhoea, five years previously. Rupture of the bladder is a very rare event. Both these consequences of Stricture are dependent on Retention of Urine, and they will be noticed under the head of Extravasation of Urine.

5. *Suppression of urine*, with uræmia, sometimes arises from slight urethral irritation; as by the introduction of an instrument only one sixteenth or number larger than that to which the patient is accustomed, or in consequence of a slight urethral abrasion, or from the mere passage of an instrument. Severe rigors and suppression of urine are both far more apt to occur when disease of the kidneys exists, so that the one becomes a tolerably sure indication of the other; and the fatal issue is more rapid and inevitable.

Certain pathological conditions of the urethra, prostate, vesiculae seminales, bladder, ureters, and kidneys, result from the mechanical effect of long-continued retention of urine. These secondary diseases are discovered, mostly after death. (1) The urethra is contracted in caliber before, and dilated sometimes into a sacculus just behind, the seat of stricture. In the latter or dilated pouch, sabulous matter and even calcareous concretions occasionally collect. Rupture of the urethra may have taken place in this dilated portion; and in connection with an abscess, usually perineal. This abscess may have opened externally, as well as communicate with the urethra,—constituting a fistula in perineo, with perhaps several branches of fistulous openings and surrounding consolidation. The ejaculatory ducts also, in the sinus pocularis, are enlarged. (2) The prostate gland has been found converted into an abscess, multilocular, or as a single cavity, bounded by the fibrous capsule; and communicating by one or more ulcerated openings with the prostatic urethra. (3) The *vesiculae seminales* are then often distended with glairy and feetid, purulent matter. (4) The bladder, subjected to the constant backward pressure of urine, which distends its cavity, is fasciculated internally, and perhaps sacculated; the one alteration of this organ representing an hypertrophied state of its muscular bands; the other, intervening pouch-like protrusions of the mucous membrane. The general result is a diminution in the

capacity of the bladder for the retention of urine, or its total capacity may be thus much increased. Rupture of this organ may have happened, though very rarely. Sometimes, it takes place in consequence of a small pin-hole aperture of ulceration in the mucous membrane of one of the *sacculi*. (5) The *ureters* have undergone dilatation by the tendency to reflux of urine, and the pelvis of these tubes may thus be found much enlarged; while the (6) *kidneys* are more or less degenerated and atrophied in their pyramidal and cortical portions, resulting perhaps in sacculated remnant kidneys, or in the formation of mere bags or cysts. Sometimes these organs are beset with multiple abscesses, as the result of pyelitis or nephritis from the backward irritation of prolonged retention. Hence the suppression of urinary secretion, with uræmic blood-poisoning.

The various forms of kidney-disease which are thus consequent on chronic retention of urine, and which give rise to uræmia, have received the name of "Surgical Kidney;" a very inapt appellation, as seeming to indicate the results of surgical interference, which would, however, have prevented the supervention of these renal conditions.

TREATMENT.—The object of treatment is twofold: to *restore* the urethral canal to its natural calibre, and to *maintain* that state of patency. But for the accomplishment of this object, different *modes* of treatment are necessary according to the various *states* of stricture; (a) its degree of *contraction* and *induration* or dilatability; (b) its *sensitiveness* and proneness to disturbance of the nervous system; (c) its *contractility* and disposition to *return*. All the modes of treatment now employed, may be reduced to three: (1) Gradual Mechanical Dilatation; (2) Immediate and Forcible Dilatation, or Rupture; (3) Division of the Stricture, either by internal urethrotomy, or by external urethrotomy,—usually perineal section.

GRADUAL MECHANICAL DILATATION,—inducing absorption of the plastic deposit around the seat of stricture. This method of treatment is most *generally* applicable; the other methods being resorted to when it proves ineffective, or when it is contra-indicated by one of the adverse states of stricture above mentioned.

The *instruments* commonly used for gradual dilatations are bougies and catheters,—inflexible, or flexible and elastic; and always of *gradually* increasing size. Sounds are more serviceable to maintain dilatation; and especially in irritable, or in resilient strictures.

A *catheter* is generally preferable; as not unfrequently the patient first seeks relief when suffering from an attack of retention, and the Surgeon having succeeded in getting an instrument into the bladder, may be very glad to leave it there. Hence, also, a catheter is generally most suitable in the *commencement* of treatment.

An instrument of such *size* only should be used as shall be found to enter the stricture easily, and can pass fairly through it without feeling tightly held by the contraction. Dilatation is then effected by leaving the instrument in this contracted portion of the canal; so as to continue the slight expansion, and induce absorption of the plastic deposit in the mucous and submucous tissues forming the stricture. The proper *period* for maintaining the dilatation is, in my judgment, about five minutes,—some say twenty minutes; then the instrument should be withdrawn, and its size or number noted as a standard of comparison in the subsequent introduction of gradually larger-sized instruments. Professor Spence's

three recommendations are, I am sure, here advisable:—always pass the size of instrument used on the previous occasion, before proceeding to the next larger size; never omit any one size to pass a higher one; never pass two larger sizes on the same occasion. An instrument may be reintroduced every two or three days. But the intervals of catheterization must be regulated by the state of the urethra, and the constitutional disturbance induced. When bleeding, pain, or smarting in micturition follow or continue after the operation—events very likely to happen after the first passage of an instrument through the stricture—further dilatation must be postponed for a day or two, until this urethral condition has subsided. Rigor or shivering, faintness or sickness, may also supervene, especially under similar circumstances; postponing any reintroduction of an instrument until this state of constitutional disturbance has passed off. Chloroform, therefore, often becomes an invaluable agent in the treatment of tight stricture by dilatation. Spence is inclined to believe that rigor arises from the irritation produced by the instrument in passing over the prostatic urethra and neck of the bladder. Hence, in using the smaller-sized instruments, when the flow of urine shows that the bladder is entered, the catheter should be withdrawn, and left only in the stricture; or in using those of larger size, the instrument is passed only through the stricture, and no farther.

For very tight strictures, the *filiform elastic bougie* may be twisted with an onward movement through the urethra, inch by inch from the glans, any obstruction being indicated by the shaft of the bougie springing back, when it should be withdrawn a little, and rotated onwards again, until it is arrested and held in the stricture. The *divaric whalebone bougie*, though almost filiform, is much stiffer, yet, being provided with an olive end, is safe in its passage; this instrument thus seems specially suited for very tight, indurated, and perhaps extensive stricture, as when of traumatic origin. The previous injection of the urethra with warm oil, to distend the passage, will much facilitate the transit of any filiform bougie, through a tight and tortuous stricture.

This plan of treatment—by gradual dilatation—must be prolonged until the urethral canal is restored to its natural size, and the stream of urine fully established. The urethra may then admit a catheter of full size—No. 12—or a bougie of equal size, with ease; when it should be passed less frequently, once in a week or ten days. Lastly, it will be necessary to maintain the patency of the canal, by an occasional use of the instrument once in a month or six weeks.

In the course of treatment by dilatation, the general health should be attended to; especially with regard to the digestive organs, and the state of the skin and kidneys.

Continuous dilatation may be advantageously resorted to when the stricture proves obstinate under the ordinary plan of gradual dilatation. *Indurated* stricture, therefore, may be so treated; or an *irregular* stricture, complicated perhaps with false passage, which may render the repeated introduction of an instrument difficult. The principle is that of rapid dilatation and dissolution of the stricture, by retaining the instrument in the contracted portion of the canal for a period varying from *forty-eight to seventy-two hours* at a time. The catheter is fastened by means of tapes passed through the eyes of the instrument, on either side, and

thence under the buttocks and over the thighs to a waist-band. If a gum-elastic catheter be used, it can be secured by a strip of adhesive plaster to the penis. A peg of wood or bit of cork is inserted into the orifice of the catheter, and the water drawn off as occasion requires.

In the management of this process, *three points* must be observed:—the catheter should occupy the stricture, without fitting tightly or being grasped by it; the instrument, when tied in, should not project against the interior of the bladder; and after using a silver instrument on the first occasion, the succeeding instrument may be gum-elastic, as causing less irritation.

When, in about forty-eight hours, the catheter has become loosened in the stricture, and a slight purulent discharge has taken place around the instrument, it should be withdrawn. In two or three days, this procedure is renewed, and an instrument larger by two or three sizes may be at once introduced; and so on until a full-sized one can be passed easily. Recontraction must then be prevented by occasionally passing an instrument, at gradually increasing intervals of time.

DIFFICULTIES AND ACCIDENTS IN CATHETERISM.—1. *Induration* or hardening of the stricture sometimes presents considerable difficulty to insertion of the point of the instrument. This may perhaps be overcome by using a conical-pointed elastic catheter, or bougie. But, if the stricture be not very sensitive, continued pressure on the face of the induration will probably cause the stricture to yield. Injecting the urethra with four or five drachms of olive oil seems to exercise an hydraulic pressure on the stricture by penetration of the fluid into the narrowed passage.

2. *Spasmodic* action must be overcome by the means appropriate for spasmodic stricture.

3. *False passage.*—A false passage, or a passage leading out of the natural urethral canal, is made by forcible and misdirected pressure with the point of any instrument in its course through the urethra. The passage, therefore, usually takes a direction downwards and backwards, and to one side of the urethral passage; in an opposite direction to the stream of urine, the free discharge of which remains unaffected. An inflexible instrument, as the ordinary silver catheter, will be more apt to cause this misadventure than a flexible instrument; but the latter is more liable to enter a false passage already existing.

The previous existence of such a passage or passages is perhaps the most common and perplexing occasion of difficulty in using an instrument; and its production, an accident most to be avoided. The importance of these considerations in relation to catheterism, lies in the fact that the difficulty of entering the right opening is increased by the facility with which the instrument slips into the wrong one.

A false passage varies in its *situation* and *extent*. When the stricture is far forwards, the passage may run into the corpus spongiosum; when further backwards, in the usual situation, the passage may perforate either lateral lobe of the prostate, or run up between it and the rectum; this latter direction being especially dangerous. The *floor* of the urethra is most commonly the seat of a false passage; and it is most liable to happen in connection with a tight stricture, and the introduction of a small-sized instrument. Hence, in the treatment of such a stricture more particularly, and when it has been subjected to the previous use

of instruments, an important practical injunction in passing the catheter is this—the point of the instrument should be kept against the wall of the upper surface of the urethral canal.

Certain signs at once indicate to the Surgeon that a false passage has been commenced, or entered if pre-existing. The point of the instrument is felt to make a sudden slip, and the shaft inclines to one side of the urethra; the point also feels free and movable, and communicates a rough or grating sensation, while it can be easily withdrawn; all these peculiarities being more notable when occurring after the instrument had been felt to be held or grasped by the stricture. The patient experiences sudden and severe pain, and is often conscious that something has given way; on withdrawing the instrument, it is found besmeared with blood, and there will be free hæmorrhage from the urethra, with, perhaps, as I have noticed, some degree of turgid priapism. But an old false passage, with consolidated walls, will communicate the same sensation as if the instrument were passing through a stricture, and is unattended with pain or hæmorrhage; the only obvious sign, perhaps, being some deviation from the natural direction in the course of the urethra.

4. *Hæmorrhage* must be regarded as another accident attending catheterism; but it is also liable to occur independently of any urethral lesion, from the mere passage of an instrument, in inflammatory stricture.

5. *Inflammation* affecting the *urethra* or *testes* may be induced by dilatation; especially with instruments of too large a size, or rapidly increased.

6. Other evil concomitants, or consequences, have already been alluded to: pain in micturition, *rigors*, faintness, sickness. These unpleasant symptoms usually pass off; but they may continue for some hours, or recur; until the patient, having had a succession of shivering fits, dies suddenly from *syncope*, or succumbs from *exhaustion*. In an enfeebled and prematurely aged state of the constitution, especially if accompanied with kidney-disease and a tendency to *uræmic* blood-poisoning, rigors are more apt to occur. The symptoms then are always perilous, the patient sinking perhaps, and sometimes rapidly, from the supervision of coma. An attack of *rigors* should, therefore, be treated promptly, by measures to promote reaction. Hot brandy-and-water, or ammonia, having been given, and the haggard-looking sufferer lying wrapped in blankets, a sweat breaks out as the shivering abates, and the temperature, which had previously been high, now declines. Otherwise, the administration of stimulants should be reinforced by *quinine* and *opium*, which have a marked influence in controlling rigor, and preventing its recurrence.

Gradual dilatation having proved ineffective for the cure of stricture, other methods of treatment must be resorted to; and they are especially applicable, when either the *sensitive* state of the stricture or its *contractile* and *recurring* tendency would render that mode of treatment inapplicable, as being intolerable or unsuccessful. The degree of *tightness* of the stricture and the amount of *induration*, together representing an undilatable state of stricture, will be found to determine the particular mode of treatment then to be adopted—whether Forceful Dilatation or Rupture, or Division by incision, internally or externally. *Traumatic* strictures especially represent the conditions for which these methods of treatment are generally requisite.

IMMEDIATE AND FORCIBLE DILATATION, OR RUPTURE.—Forcible dilatation is effected by means of *distending instruments*, which when passed through the stricture exert an expanding force from within outwards. Such force may be accompanied by a *series* of instruments, consisting of *sliding tubes*, passed successively over a slender urethral director or guide, which is first passed through the stricture; or, it can be effected by means of a *single instrument* which *expands in situ*.

RUPTURE OR SPLITTING OF THE URETHRA.—This mode of forcibly opening stricture of the urethra is most applicable to tight stricture, *without* much induration; so that the plastic deposit does not form a mass too thick or dense to be entirely ruptured. Rupture may, therefore, possibly supersede the necessity for division by a cutting operation.

The “dilator” generally used is similar to that of Perrève. Its construction, and his mode of operating, he thus describes:—The instrument consists of two grooved blades fixed in a divided handle, and containing between them a wire welded to their united point; on this wire a tube—which when introduced between the blades corresponds to the natural calibre of the urethra—is quickly passed, and thus ruptures or splits the obstruction. Having introduced the instrument, and reached the bladder, it should be gently *rotated*, to prove that the end is fairly within that viscus; and being thus assured, the Surgeon is next to place the point of the tube he had previously selected, upon the wire between the blades, and thrust it quickly onwards to the end. The stricture being now fairly split, the dilator should be rotated, to still further separate the sides of the rent, and then be withdrawn; a catheter, corresponding to the number of the tube, being substituted for the purpose of removing the urine. The *catheter* is then *withdrawn*, the patient treated with quinine and opium for the first twenty-four hours; and the same catheter introduced occasionally perhaps during that period, to prevent any risk of urinary infiltration in micturition; or in forty-eight hours, to maintain dilatation; and again on alternate days for a week or two, gradually lengthening the interval. The *results* of this procedure have proved eminently successful, in the hands of some Surgeons. Rigors, and constitutional disturbance, may follow; and extravasation of urine has been known to occur. Death in some cases.

DIVISION OF THE STRICTURE.—Section of the urethra may be resorted to in tight stricture, with considerable induration, forming a hard and large *nodule*, unfitted for rupture; and accompanied perhaps with much sensitiveness and irritability, or contractility and resiliency—conditions which are also unfitted for gradual dilatation. The incision is made, either from within the urethra, or from without, and usually in the perinæum.

(1.) **INTERNAL URETHROTOMY.**—The operation may be performed in two ways:—*incision from before backwards*—section being made by pushing downwards a lancet-like blade, generally with a slender conductor in advance of it, into the obstruction to be divided; *incision from behind forwards*,—a portion of the instrument containing a small blade, sheathed, is first carried down through the stricture, which is then divided by protruding the blade downwards and withdrawing it, in the *floor* of the urethra, through the whole of the contracted portion, with a little of the sound urethra in front and behind, but taking care not to incise

too freely in depth. Thus, the length of this incision may be from one to two inches, while its depth should not exceed more than half that to which the blade can be projected in Civiale's instrument. The penis should be stretched to steady the otherwise movable urethra. Of the two methods of operation, the *former* is suitable for *antibulbous* strictures—the urethra being straight in that portion of its course, is not liable to perforation; *deeper* strictures, situated in the curve of the canal, had better be incised from *behind forwards*.

Various instruments, or *urethrotomes*, have been constructed for the internal division of strictured urethra. Trélat's urethrotome can be used in both ways,—from before backwards, and then from behind forwards; thus making a second incision when necessary, and the operation more complete. After either mode of operation, a *full-sized catheter* should be introduced along the *roof* of the urethra, to avoid the incision, and retained for twenty-four hours; although some Surgeons of experience think the latter practice unnecessary or objectionable. An instrument should also be passed occasionally, for some time, to prevent recontraction. A urethrotome provided with a *terminal filiform bougie*,—as devised by Maisonneuve, or the similar shielded instrument of Voillemler, will enable the operator to deal with *very tight* strictures.

The immediate effects and after-consequences of internal urethrotomy are, seldom serious,—very rarely fatal. Hæmorrhage, beyond a few drops of blood, is rare, and easily stopped by passing a full-sized instrument, and the application of ice externally. Some feverishness often ensues, but soon subsides. Abscess and extravasation of urine are very uncommon; while cystitis, nephritis, and pyæmia are unknown.

The *results* of internal urethrotomy are also satisfactory, as regards the immediate restoration of the urethral canal to its natural calibre; the ultimate result may be permanent, or evince a tendency to the return of stricture,—generally, however, amenable to dilatation. But it should be observed that in both modes of internal urethrotomy, the strictured portion of the canal must be generally large enough to admit an instrument equal in size to a No. 4 or 5 catheter; and that with this degree of patency, it may well be considered probable that further and perhaps complete enlargement might be accomplished by dilatation.

(2.) **EXTERNAL URETHROTOMY.**—*Perineal section*, as the operation of external division of the stricture may be generally designated, is applicable in two degrees of extreme urethral contraction:—*permeable* stricture, through which a slender grooved staff can be passed, and the external incision made upon this instrument; and *impermeable* stricture, through which no instrument *apparently* can be passed, the only guide being a full-sized instrument passed down to the stricture, towards the point of which the external incision is directed.

The condition of stricture appropriate for perineal section is that of considerable, even *cartilaginous, induration*, both in *thickness* and *extent*, appreciable usually by external examination with the finger; coupled perhaps with perineal fistulæ, either chronic or numerous.

(a.) *Permeable Stricture.*—Perineal section, by Syme's operation, is performed as follows:—The instruments required are—a staff, slender, slightly curved, and well grooved in its lower half, and the upper of full size; a pointed scalpel; a broad director; and a silver catheter, No. 8 or

10. The staff is passed *through* the stricture, so that the shoulder or termination of the upper thick portion rests against the upper part or face of the stricture. The patient is tied up as for lithotomy, and the staff held in like manner by an assistant, with the scrotum drawn forwards. The Surgeon, sitting in front, makes an incision in the raphé or *median line* of the perineum, about two inches in extent, and proceeds cautiously straight to the shoulder of the staff, feeling his way with the forefinger of the left hand. Having clearly reached that point, he takes the staff from the assistant in his left hand, and enters the point of the knife in its groove, *behind* the stricture (Fig. 144); thence cutting *upwards* to the

FIG. 144.

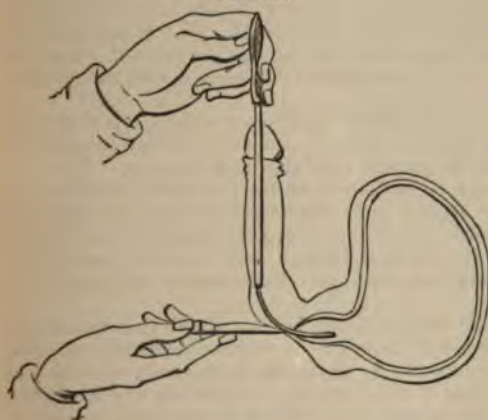
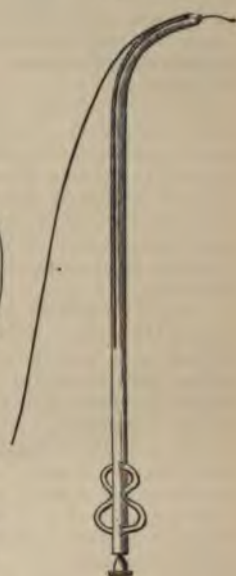


FIG. 145.



shoulder of the staff until it can be passed onwards into the bladder. This instrument is then withdrawn, and the No. 8 catheter introduced, and retained for forty-eight hours. The presence of a catheter has been condemned, as being possibly a source of irritation; but it preserves the full patency of the canal, as well as precluding the escape of urine, during the closure of the urethral incision. Subsequently, a full-sized catheter should be passed every three or four days, and afterwards at longer intervals, to prevent recontraction,—when the urethra has closed, and during granulation of the perineal wound. Difficulty in introducing the catheter, after withdrawing the staff, may be overcome by first passing the *director* into the urethral wound, along which, as a guide, the catheter glides into the bladder. But Gouley's *catheter-staff* (Fig. 145) is especially adapted to obviate the difficulty which thus arises in the operation with Syme's staff. The former instrument being a catheter, is not withdrawn, and the groove on its convexity terminates in a loop, for the transmission of a filiform whalebone guide to the catheter, in passing it through the stricture into

the bladder. Hæmorrhage rarely proves troublesome immediately after the operation, or subsequently; and it can be stopped by careful plugging of the wound, then placing a compress over it, and retaining the whole in position by a T-bandage,—a catheter being kept in the bladder.

The following directions are given by Mr. Syme, as essential to the success of this operation:—(1.) Maintain the median line in the incisions. (2.) Make a direct opening down to the staff, not a tortuous one. (3.) Divide the whole of the contracted part, rather more than less. (4.) Do not cut so far back as to endanger the deep fascia of the perinæum, and use the knife in the deep incisions with the cutting edge uppermost. (5.) Do not close the end of the inlying catheter, lest urine be forced into or through the wound, for want of patency in the instrument. (6.) Avoid escape or displacement of the instrument. (7.) If incisions are made far back, introduce a curved tube through the wound when the catheter is withdrawn. (8.) Do not neglect dilatation during the progress of recovery.

(b.) *Impermeable Stricture.*—This condition of stricture is very rare, if it ever exists. Any stricture, through which urine can escape, will admit an instrument to be passed with care and patience. Then, of course, the operation may be performed as for permeable stricture. A filiform whalebone guide having been introduced through the stricture, the catheter-staff is passed over it (see Fig. 145) down to the front of the stricture, and then the urethral incision may be readily and safely followed up along the black line, until the catheter can be slid on into the bladder.

When *no* director, however small, can be introduced, the dilated portion of the urethra—*behind* the stricture, may be punctured, and a director passed up to meet the point of the knife coming *downwards*, from the end of the catheter-staff, in *front* of the stricture; or the knife may be at once carried *forward*, with the director, from *behind* the stricture, to the end of that instrument.

To meet the difficulty of hitting the point of the staff in *front* of the stricture, Mr. Wheelhouse, of Leeds, performs the operation of perineal section with a straight grooved staff or director, having a slightly hooked extremity, the groove terminating within a quarter of an inch of the extremity. This instrument is passed down until the end rests lightly *against* the stricture. A median perineal incision is made, reaching the urethra only a quarter of an inch above the end of the director, and therefore falling into the groove, without exposing the hooked end, which is then turned round to the front, made to hook up the upper angle of the wound, and held steadily in position by an assistant. Two other assistants retract the sides of the wound, so as to expose the urethra where the anterior part or face of the stricture must be situated. By searching with a probe, this spot will now be found and opened, and the director carried thence through the stricture, which is then divided in its whole extent. A catheter is introduced into the bladder, and tied in for a few days. (*British Med. Journ.*, June 24th, 1876.)

Results of Perineal Section.—The operation has yielded excellent results,—in a suitable condition of stricture, and when the operation has been properly performed. The mortality is between six and seven per

cent., mostly from pyæmia, occasionally from suppression of urine. Neither hæmorrhage nor urinary infiltration ranks as a cause of death from perineal section. But the stricture almost always returns, unless catheterism or the passage of bougies be practised, occasionally, for some time after recovery from operation.

Spasmodic Stricture.—This kind of stricture is due to the spasmodic action of the muscles surrounding the urethra, and is of a *temporary* character. It rarely occurs alone, but usually as a supervention on organic stricture, or in connection with an inflamed state of the urethral canal. Spasmodic stricture may occur at any portion of the urethra, by contraction of the layer of involuntary muscular fibres which encircle it throughout its course; or the membranous portion of the urethra may be constricted by spasm of the *compressor urethræ* muscle, acting as a sphincter on this portion of the passage, and this is the usual seat of a spasmodic stricture of the urethra.

The **SYMPTOMS** are those of obstruction to the passage of the stream of urine, but of *temporary* duration, although perhaps oft-recurring. They thus differ from the same symptoms in organic or permanent stricture.

CAUSES.—Local and *urethral* conditions, or *remote* and *constitutional* conditions, may severally give rise to spasmodic stricture. (1.) The first class comprises, principally—the presence of *organic stricture*; of inflammation from *suppressed gonorrhœal* discharge; irritation of the urethral mucous membrane from various states of the *urine*, especially a highly acid state,—in various constitutional conditions, as *gout*; *foreign matters* ingested and expelled by the urine, as cantharides, turpentine, condiments, alcoholic drinks; and the voluntary retention of urine for too long a time. (2.) The second class of causes includes, chiefly—*rectal irritation*; as from hæmorrhoids, fissure, prolapsus, fistula, operations on the rectum, ascarides, and anal prurigo; derangements of the *digestive organs*, and of the *cerebro-spinal* system. The *social* circumstances under which the practitioner will commonly meet with spasmodic stricture are characteristic. As affecting the more affluent classes of society, the indulgence overnight of acid wines, punch, or stimulating food and condiments, at supper-parties or convivial meetings, may be followed next morning by an attack of spasmodic stricture, especially in persons of a gouty diathesis. The restraints of society with regard to the retention of urine, the outdoor amusements of hunting, steeplechasing, or other rough riding across country, are also circumstances under which spasmodic stricture is liable to occur. Or the picture may be reversed; the combined effects of *cold* and *exhaustion* drive many a homeless wanderer to seek relief at an hospital during the early hours of our winter mornings. The anxiety and harass of business, the pressure of over-study, or of writing against time in newspaper offices, etc., not unfrequently subject the commercial and the literary classes of society to the penalty of an attack of urethral spasm.

TREATMENT.—The cause of spasm must be sought, and if possible removed. In an attack of spasmodic stricture, remedial measures should be directed to the *relaxation* of the muscular contraction. The most effectual antispasmodics are a *warm bath*, and a full dose of *opium*,—the tincture or Battley's sedative. I have used a drachm or more of the

compound tincture of camphor with advantage. Chloroform, inhaled, has sometimes afforded instant relief. Suppositories have not had much effect. This antispasmodic treatment is most successful when the stricture arises from exposure to cold. But if the *gouty* diathesis prevails, or the circumstances of origin point to acidity of urine, then alkalies and other appropriate remedies must be combined. *Catheterism* should be avoided as long as possible, the introduction of an instrument tending to provoke spasm; and when resorted to, the catheter used should be full-sized, or at least one of the higher numbers.

Inflammatory Stricture.—An inflamed or congested state of the urethral mucous membrane may occasion a species of *temporary* stricture. It is less an independent condition, than engrafted on a pre-existing organic stricture, or coincident with spasm.

The SYMPTOMS are somewhat peculiar. In addition to obstructed micturition, the *penis* is *turpid* and erectile, and the *urethra* *bleeds* freely on the introduction of even a moderate-sized catheter; there is intense scalding in passing urine, and the stream narrows rapidly during the act, ceasing abruptly before the bladder is emptied. The urine is, as it were, shot out at short intervals from the bladder, itself in an irritable state. *Perineal* heat, fulness, and tenderness are complained of, when the inflammation extends far back. In all these respects, inflammatory stricture contrasts with that produced by spasm.

As CAUSES of this kind of stricture may be mentioned *retrocedent gonorrhœa*, or suppression of the discharge by exposure to cold or wet, or by an inconsiderate recourse to injections during the inflammatory stage. Indulgence in alcoholic liquors or a stimulating diet will also contribute to the inflammatory or congested state of the urethra.

TREATMENT must be conducted on ordinary principles. This urethral condition resulting usually from suppressed gonorrhœa, it will subside on the reappearance of the discharge. Wrapping the penis in a poultice is a simple remedy which I have often found successful.

Calculus in the Urethra.—Urethral calculus is generally derived from the kidney and bladder, or from a fragment of stone becoming arrested in some part of the canal—after lithotripsy; but rarely the calculus forms within the urethra, by deposit in the *sacculus* or dilatation behind a stricture. Here urine constantly collecting may give rise to concretion, or it forms around a particle of calculeous matter as a nucleus.

The calculus is usually of the *uric-acid* variety; it more than occupies the calibre of the canal transversely, and assumes an elongated form; it may attain to a very large size. Several calculi are sometimes present; small, smooth, and faceted.

The SYMPTOMS are obvious; frequent and difficult micturition, bordering on retention; and the stone may be *felt externally* in the perineum or detected by introducing a *sound*, which at once strikes against the calculus, or grates roughly over it when imbedded in a dilated portion of the urethra. *Rectal* exploration with the finger is often serviceable. Care must be taken, in either case, to guard the canal on the vesical side with the finger, lest the stone be pushed back, or might slip back into the bladder. Pain in the situation of the calculus is sometimes experienced, especially if the stone be rough, and movable in the act of micturition;

but not unfrequently there is no such symptom, and the calculus lies singularly quiescent and unsuspected.

Ulceration and abscess are liable to ensue, resulting in extravasation of urine, and urinary fistula.

TREATMENT.—The calculus may perchance be expelled in the passage of a full stream of urine. Hence, the Surgeon sometimes avails himself of this natural mode of cure, by directing the patient to retain his water as long as possible, and then to compress the urethra with his fingers in front of the calculus when he endeavours to micturate; the stream of urine, coming out suddenly with a forcible gush, carries before it the stone. The removal of a urethral calculus must, however, generally be effected either by *extraction* or by *incision*.

1. When situated in *front* of the scrotum, the calculus can often be extracted by passing down the urethra a long, slender, urethral forceps, aided by moderate dilatation; or, failing thus to remove the stone, it should be pushed back into the perinæum, and then removed by incision, any incision of the urethra in front of the scrotum generally resulting in a fistulous opening. A stone lodged in the navicular fossa near the meatus, may be eased out with a small scoop by dilatation; or by a slight incision of the orifice with a probe-pointed bistoury, which I disapprove of as liable to induce stricture.

2. When the calculus is situated in the *perineal* portion of the urethra, or has been pushed back to that part, it should be removed by a clean median incision on a grooved staff—*external urethrotomy*—at the same time compressing the urethra firmly with the finger behind the stone, lest it accidentally recede into the bladder. If this happens, a long pair of slender forceps can perhaps be introduced and the stone extracted. After the perineal section, there is little risk of urinary extravasation, and less of fistula or of stricture resulting.

3. In the *membranous* or *prostatic* portions of the urethra, an impacted calculus may admit of extraction by the median operation of lithotomy. Or, the stone can be pushed back into the bladder, either by means of a large-sized catheter, or by urethral injection. It may then be removed by lithotrity or lateral lithotomy.

Foreign Bodies of all sorts have been introduced into the urethra by persons, to gratify some morbid curiosity or prurient feeling; and any such body having slipped out of reach, surgical assistance becomes necessary. Thus, a *hair-pin* has been passed into the urethra, and the ends expanding and sticking in the mucous membrane, they cannot be secured with forceps. But if the pin be compressed through the urethra, with the thumb and finger, a small thin tube may be slid over the ends of the pin, which can then be extracted through the tube. In the *Female*, the removal of a urethral calculus, or other impacted foreign body, can be accomplished by dilatation of the passage; or this procedure may be necessary to reach a urethral growth.

The **CONSEQUENCES** of a foreign body in the urethra may be the speedy supervention of inflammatory swelling, with retention of urine; or, calculous encrustation takes place; often, however, the substance passing back into the bladder, it there forms the nucleus for stone.

TREATMENT for the removal of any foreign body must be conducted as for urethral calculus.

Retention of Urine.—This term is understood to signify an inability, arising from various causes, to pass any urine, or only a very small quantity. It thus differs from the partial retention of urine in engorgement of the bladder with occasional overflow, and which is dependent on enlargement of the prostate. Moreover, the one is a recent or acute condition, the other an habitual or chronic condition.

The SYMPTOMS are not only an absence of micturition, or the escape of urine by drops after much straining and painful effort; but also, as the bladder becomes distended and rises above the pubes, there is *dulness* on percussion over that region, extending upwards at length perhaps to the umbilicus. Pressure provokes a desire for micturition, unless the bladder has become insensitive. In the *rectum*, the base of the bladder can be felt with the finger to be distended, and supra-pubic palpation produces fluctuation. Some dribbling of urine from the urethra at length betokens extreme distension, but without affording any real relief. This condition is accompanied with much distress and constitutional disturbance.

CAUSES.—Various causes may give rise to retention of urine, but they are all reducible to two classes: (1) that of *Defective expulsive power*,—from *atony* of the bladder, or in *paralysis* involving the abdominal muscles and bladder, and from hysteria, shock, coma, concussion, or other cerebral conditions, typhus and other fevers; (2) that of *Obstruction* to the passage of urine, as dependent on *prostatic enlargement* from any cause,—inflammation, chronic hypertrophy, or tumour of a sufficient size to block up the vesical orifice of the urethra; *perineal abscess*, occasionally; *stricture of the urethra*, organic, spasmodic, or inflammatory; *urethral tumours*, *calculi*, or other foreign bodies in the urethra, occasionally. Other more rare causes of retention may be noticed; obstruction from *within the bladder*,—by a stone, a tumour, coagulated blood, thick mucus, or a false membrane; in the urethra,—by peri-urethral deposit or tumour, or by phymosis. *Pelvic tumours*, e.g. a cyst between the bladder and the rectum, or a growth from the pelvic bone, may also be mentioned; pregnancy, uterine tumours, flexions and versions of the uterus, are occasional sources of obstruction; and impaction of the rectum with feces or a foreign body is sometimes met with.

Unrelieved retention of urine leads generally to *rupture of the urethra*, and especially when the source of obstruction is in the urethra, the canal yielding behind that point, and this event being followed by extravasation of urine; rarely, *rupture of the bladder* occurs in consequence of retention.

TREATMENT.—Retention of urine must of course be regarded with reference to the removal of its cause; but the bladder admits of being entered, and the accumulated urine drawn off, in five different ways:—(1) by catheterism; (2) external urethrotomy, through, or behind, the obstruction, usually in the perinæum; (3) puncture of the bladder through the rectum, (4) above the pubes, or (5) through the symphysis pubis. The latter situation for puncture is now abandoned.

(1.) *Catheterism*.—This mode of gaining admission to the bladder will usually succeed, in conjunction with the treatment for any temporary spasmodic or inflammatory obstruction, which may have become engrafted on an *organic stricture*, from some excess or from exposure to wet or cold.

—the circumstances under which retention generally arises. Accordingly, a small-sized catheter is selected, about No. 4 or smaller, silver or gum-elastic; and the instrument introduced with due attention to gentleness, caution, and patience. The stricture may often yield more readily than might have been anticipated, when retention is present, owing to the dilatation effected by the pressure of urine above; or on withdrawing the instrument from just the entrance of the stricture, the urine will often follow in a full stream. Having passed the usual seat of stricture—at about the bulbous portion of the urethra, the instrument may be arrested, owing to the *acute angle* of the urethra, behind the triangular ligament, as the distended bladder rises out of the pelvis. A catheter of sharper curve must be used. If the Surgeon fails in thus affording relief by catheterism, he should have recourse to relaxatives or local blood-letting, as the case may be. With *spasmodic* stricture, the patient should be placed in a warm bath, and opium given by the mouth, or in the form of enema or suppository, or chloroform administered; the latter agent being of great value in overcoming both voluntary and involuntary muscular resistance. With an *inflammatory* or congestive state of the urethral passage, as evinced by a turgid penis and tender perinæum, local blood-letting from the latter region by cupping, or a dozen leeches, will often effectually subdue this occasion of resistance. After either kind of auxiliary treatment, the introduction of a catheter can generally be accomplished. Recourse to auxiliary measures may be deemed advisable *before* attempting to pass an instrument, and certainly this would be better than any risk of injuring the urethra by rough manipulation.

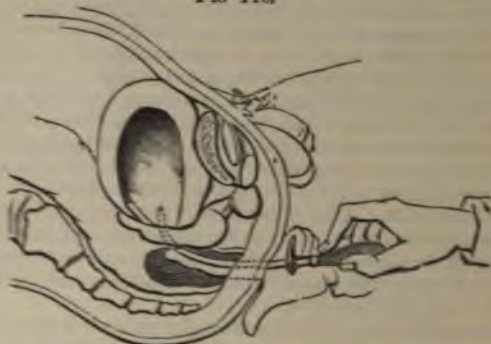
Forcible catheterism, or forcing the stricture, as it is termed, will rarely be justifiable, and never in the sense of thrusting a catheter anyhow into the bladder. The forcible dilatation or rupture of an old indurated stricture, as by the splitting operation, offers an occasional resource for the relief of retention.

(2.) *External Urethrotomy*.—*Incision of the Urethra through, or behind, the Stricture*.—The first-named point of incision—through the stricture—is, in fact, *perineal section*; and the second—behind—may be performed in a precisely similar manner. The one has the advantage of relieving the stricture as well as the retention; the other leaves the stricture untouched, and it is performed without perhaps even a filiform guide in the urethra, by carefully deepened incisions so as to hit the passage; the finger having been introduced into the rectum to indicate the point in front of the prostate—the membranous urethra. Both these urethral modes of entering the bladder have the advantage of not directly opening the bladder; and, in relieving retention, they also release any extravasated urine or matter which may have formed in the perinæum.

(3.) *Puncture of the Bladder through the Rectum*.—Having emptied the bowel by an enema, the patient is brought to the edge of the bed, and his legs held apart as for lithotomy. The Surgeon then introduces the left forefinger, oiled, into the rectum, and feels for the posterior margin of the prostate; just beyond which point, bulging fluctuation should be perceptible, especially on tapping the hypogastric region with the other hand. The long curved trocar and cannula is then passed along the concavity of the finger, as a guide, to the same point in the middle line, and pushed upwards into the bladder, transfixing the rectum and base of the

bladder in the *trigone* of the latter organ, where it is uncovered by peritoneum (Fig. 146). This space is free from adjoining parts; the prostate is front, the reflexion of the peritoneum behind, and the vesiculae seminales on either side. The trocar is now withdrawn, the bladder emptied, and the cannula retained by means of a waist-bandage and tapes. In performing this simple operation, two additional practical points are worthy of notice: in passing the instrument along the finger, let the point of the trocar be withdrawn into the cannula, to avoid wounding the bowel; and leave the cannula in, but only just within the bladder, to prevent any

FIG 146.



irritation of the mucous membrane by the edged end of this tube. It is allowed to remain for a few days, until urine flows by the natural channel, or until stricture of the urethra or other obstruction has been overcome.

The objections to this operation are the liability to urinary infiltration, pelvic inflammation and abscess between the rectum and bladder, and a persistent fistulous opening.

Puncture through the rectum should be resorted to *only* when, with retention from stricture, there is no sign of abscess or extravasation in the perineum; the urethra is apparently not dilated behind the stricture, nor the prostate much enlarged; and a catheter cannot be passed, under chloretiform, with care and patience.

4. *Puncture of the Bladder above the Pubes* is easily performed. A vertical incision in the middle line, just above the symphysis pubis, is made and carried down through the linea alba, so as just to admit the tip of the finger to reach the distended bladder—below the peritoneal fold, which will have receded owing to the state of distension. An assistant steadies this organ by even pressure with his hands against the abdominal wall on either side; and a long curved trocar is entered downwards into the bladder, the urine drawn off, and the cannula allowed to remain for a few days, as may be necessary. It is secured by tapes and waist-bandage.

This operation has been repeated often in the same case,—as many as six times in eight days, without any adverse symptoms. Supra-pubic puncture is not, however, generally adopted. The objections are—some risk of

urinary infiltration, or of a fistulous opening remaining. But there may be no alternative between supra-pubic puncture and perineal section,—when, with impassable stricture, the prostate is considerably enlarged. Rectal puncture may then be absolutely impracticable, from the impossibility of reaching with the finger behind the enlarged prostate.

Aspiration above the pubes is the safest method of evacuating the bladder; and it is practicable whatever may be the cause of retention. This procedure may also be repeated as often as occasion requires, without any evil effects. The operation—scarcely worthy of the name—is readily performed, by entering the needle of the aspirator in the middle line, just above the pubes, and with a sharp thrust through the abdominal wall into the bladder. As the urine runs off into the exhausted receiver, and the bladder collapses on the needle, its point may wound the mucous membrane. Hence, it is preferable to use the fine trocar and cannula, in connection with the aspirator.

The method of supra-pubic puncture by aspiration allows time for renewed attempts to enter the bladder per urethram; rectal puncture, therefore, is, in my judgment, even a less justifiable resource than formerly. Thus, it often happens that, soon after the relief of retention by aspiration, the attack arising from temporary prostatic congestion subsides, reducing the enlargement, so that a prostatic catheter—metallic or flexible—can then be passed into the bladder.

PERMANENT RELIEF OF RETENTION.—In treating the causes of retention, as arising from obstruction to the passage of urine, it not unfrequently happens that, eventually, the causative condition—be it stricture or prostatic hypertrophy—so gains ground, that the bladder is never completely emptied of its contents,—there is always partial retention; recourse to catheterism becomes necessary with increasing frequency; the introduction of an instrument into the bladder becomes more and more difficult; the bladder, provoked by the constant presence of some urine, falls into a state of chronic cystitis, demanding the yet more constant relief of retention; and ultimately the patient is worn out by suffering.

(1.) Under these circumstances, in the course of *urethral stricture*, one operative procedure after another may have been tried, in vain; “splitting” of the stricture having failed in its result, “urethrotomy”—internal, or external—as perineal section, has been followed by the same issue: the stricture has recurred, it is still, or has become, all but impermeable; and thus the relief of retention and its consequences have been only temporary. The patient must die, at no distant period.

Puncture *per rectum* would be obviously out of the question, as a method of establishing a permanent opening into the bladder; seeing that a fistulous passage in that situation would become a faecal communication.

Supra-pubic puncture has answered well for the permanent relief of retention in old-standing cases of stricture; a tube in the bladder having been used for years, as the channel by which all urine passed.

(2.) In *advanced* prostatic hypertrophy, the increasing suffering from almost complete retention, and the incessant passing of a catheter, at last culminates in the crisis of demanding, if possible, some permanent means of relief. Here again, *rectal puncture* cannot be entertained, even if such a procedure were practicable, in the case of a very large, massive

In the **FEEMALE**, retention of urine may arise from certain *special causes* of *mechanical obstruction*—as from the accumulation of menstrual fluid causing an impacted hymen; during pregnancy or parturition, from enlargement of the gravid uterus or the head of the child upon the urethral canal; and uterine tumours or displacements of the uterus may act in like manner. *Functional* retention, of functional and paroxysmal character, is *exclusive* *peculiar* to the female sex.

By passing the forefinger of the left hand into the opening of the vagina, and where its upper margin lies the orifice of the urethra—and which is itself a small round opening, set in an elevation, this being sometimes covered and enlarged under the circumstances of urinary retention. As the catheter is passed from the catheter is slid, with the right hand, upon the lower margin of the left forefinger, and is thus guided into the vagina. The simpler method is to take the clitoris as an indication of the position of the urethra. Placing the forefinger on that spot, and passing the catheter into the symphysis, or inner labia of the vulva, the catheter is then passed, and with an inclination backwards, it will pass into the bladder.

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fascia, it forms a bag, limited by the base of the triangular ligament below, and the rami of the pubes laterally; thence continuing upwards, the scrotum and penis become infiltrated, then the lower part of the abdomen, and outwards to the line of Poupart's ligament on either side; but there is no extension downwards on the thighs.

The SYMPTOMS of extravasation are remarkable:—the characteristically *bounded swelling*, and its increasing size and extent; the scrotum and penis especially becoming enormously distended,—the one perhaps to the size of a large cocoa-nut, the other to that of a Bologna sausage; a sensation of *sudden relief* of the distended bladder is immediately followed by an *acute burning* sensation in the perinæum; *gangrenous inflammation* of the cellular texture soon supervenes, the skin assumes a dusky-red hue, purplish or black gangrenous spots appear, and frequently one such patch is seen on the dorsum of the penis. Ultimately, sloughing of the skin and cellular texture of the scrotum exposes the testicles, bare and pendulous. Sometimes the urethra bursts just in *front* of the *bulb*; when, in addition to the swelling of ordinary extravasation, the urine infiltrates also the *corpus spongiosum* of the penis, which is soon followed by gangrene of the glans, in the form of black spots or having a generally black appearance; thus indicating this further urinary extravasation. The *constitutional* disturbance is that of low typhoidal depression; a rapid feeble pulse, dry brown or black tongue, and muttering delirium as death approaches.

The DIAGNOSIS might be misled by the resemblance of the swelling to that of *phlegmonous erysipelas*; but the above characters, taken in connection with the retention of urine, will indicate the nature of the attack.

TREATMENT.—The primary indication of treatment is to give an immediate, free, and dependent outlet to the extravasated urine, with the fetid purulent fluid and sloughs of cellular texture which soon form. This indication is, therefore, both preventive and remedial. Hence an *incision* or two should be made in the *scrotum* on *either side* of the middle line; exposing the cellular texture, and extending from the front to the back of the bag. Another incision may be made on the *dorsum* of the *penis*, and perhaps another over the pubes. A quantity of strong smelling or ammoniacal urine trickles out, and continues to ooze for hours or days; at the same time, the peculiar appearance of the cellular texture—its pearly white colour and tension, or its opaque, sodden, and matted appearance—indicates the urinary infiltration, or the supervention of sloughing. Tension having been thus relieved, a *catheter* can often be passed through the stricture into the bladder. This should be done at once, and the instrument retained in the usual manner by means of a waist-band and tapes. The catheter is left *unplugged*, that the urine may drain away from the bladder, and as the instrument occupies the *calibre* of the urethral canal, both these provisions will prevent any further extravasation. By this arrangement also, the ruptured urethra heals over the instrument. A large poultice or warm fomentation, or an antiseptic application, is placed around the scrotum and over the whole extent of the extravasation. The relief afforded by the incisions is almost instantaneous, the patient often soon rallying from the previous state of nervous prostration and low fever. *Stimulants*, in the form of wine or brandy, with supporting nutriment, may now be given advantageously; and

AND THE CURE OF IT, IS SIMPLE, WILL PROVE VERY BENEFICIAL. TAKE, AS SOON AS POSSIBLE, AFTER IT IS THE EARLY PERIOD, TO CONTRIBUTE TO THE EXERCISES WHICH ARE NECESSARILY ACCOMPANIES PROSTRATION, AN EXERCISE, WHICH SOMETIMES SOMETIMES PROVE, TO SUBDUCE IT.

After treatment of sampling and granulation, after a long and short time, a treatment and repair, must be conducted on oil.

3. Retention of the Semen—a very rare consequence of retention
—a semen will exude from the urethra into the peritoneal cavity; a
very uncommon. Now, the line of the peritoneal reflection, into the pelvic
cavity above, whence it may occasionally get into the peritoneum by
descent.

The symptoms are sudden and acute abdominal pain, the patient usually lying on one side, and vomiting and purging; and there is overwhelming prostration. There is a permanent fever in the region of the bladder is now increased to great abdominal tenderness and distention, with total cessation of motion and a tympanic belly. The most acute peritonitis sets in. Shock and collapse supervene and terminate the collapse, but death is postponed a short time, from three to six hours to four or five days.

It is the duty of the Government to prevent any further loss of life and to the evacuation of that which has been damaged. For this purpose, the measures taken by the Government are as follows: the number is reduced by injury

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the lower extremities, and to restore the secretion of urine. But the lower should be treated ~~with~~ ^{by} cupping the loins, or dry-cupping:

with sudorific medicines, the warm bath or hot-air bath, in order to promote sweating, and purgative enemata, thus also to aid the elimination of excrementitious matters. Whether stimulant diuretics should be administered to force the kidneys to renew their functions, is a very questionable practice, both in regard to its efficacy and safety. For this purpose, however, cantharides has been given in grain doses, coupled with the application of a large blister to the loins; and this method of treatment is said to have proved successful in some instances.

Obstructive suppression of urine presents a different clinical history to that which depends on renal or systemic disease. It arises commonly from the *impaction* of a *renal calculus* in the ureter of one kidney; the other organ being diseased, or incompetent for a full secretion of urine. At first, therefore, some urine is secreted; but even this is not of a sufficiently excretory character,—it being pale and watery, and having a very low specific gravity, although without albumin. This *partial secretion* of *defective* urine is more or less completely *intermittent*; to-day, some urine is passed; to-morrow, less; then perhaps none for two or three days; followed by some resecretion, and so on. Thus, in the course of suppression, a variable quantity of urine is passed, amounting to a few ounces, or possibly pints, ere complete suppression prevails.

The *symptoms* of anuria proceed slowly; a week, perhaps, elapsing before marked indications of uræmia ensue; but then the patient succumbs rapidly, in three or four days, as in the usual period from suppression depending on other causes. The symptoms themselves are also modified in suppression from obstruction. The cerebral functions are less obscured. Wandering delirium and drowsiness may subside into stupor rather than coma; but, not unfrequently, rational consciousness is retained at intervals up to the last. Muscular twitchings set in, but rarely convulsions; and the pupils become contracted. Profuse perspiration often supervenes, but the sweat has no urinous odour. The patient lying recumbent in this state, with the laboured respiration of typhoidal oppression, gets weaker and weaker; at length dying from exhaustion as much as from uræmia.

TREATMENT should be directed to the removal of the obstructive cause of suppression, which is usually an impacted calculus in the ureter. Whatever measures, therefore, may avail for the treatment of renal calculus, to promote its descent into the bladder, may be here applicable. It does not appear that the administration of stimulant diuretics, to force the other kidney to an increased or compensatory secretion, would prove effectual, but rather prejudicial.

Incontinence of Urine.—An involuntary escape of urine differs from frequent micturition, which is of a voluntary, although painfully urgent, character.

Incontinence may occur under two opposite conditions. In *children*, and only during sleep, when the voluntary power of retention is temporarily suspended, the sphincter may be relaxed, and the bladder then empties itself; in *adults* of all ages, from retention amounting to *overdistension*, a certain quantity of the urine runs off, leaving a quantity still retained,—an event which may happen during sleep or waking. An involuntary escape of urine, in the adult, always indicate a *distended*, not an empty, state of the bladder.

The CAUSES of incontinence differ accordingly. In childhood and youth, from relaxation of the sphincter, it generally arises from debility, or intestinal irritation; sometimes from the evil habit of masturbation, or an acid state of the urine. In adult life, its causes are those of retention—paralysis affecting the bladder, atony from over-distension, stricture, enlarged prostate, cystitis, stone. In the female, incontinence is generally the result of some injury to the urethra, impairing or destroying the action of the sphincter; such as sloughing from pressure in difficult labour, from the application of instruments in delivery, or from over-dilatation of the urethra for the removal of stone in the bladder; but the incontinence is not unfrequently an hysterical affection.

The neck of the bladder is sometimes the seat of structural disease or malformation; occasionally, of disorganization resulting from injury, as from a kick or fall on the perinæum, or the operation of lithotomy. In such cases there is no power of retention; the unhappy sufferer has lost, or may never have possessed, command over his bladder, and the sphincter is itself powerless to contract. The incontinence is then usually a *cessant* dribbling, the urine running off from the bladder as fast as it arrives there from the kidneys. This condition, therefore, differs from both the ordinary modes of incontinence, in childhood or adult life. It differs also from frequent micturition, not only in its involuntary character, but in there being no distinct acts of micturition.

TREATMENT.—In *Children*.—A general tonic plan of treatment is indicated, combined sometimes with sedatives. The vinum ferri is often beneficial, or the sesquichloride of iron, quinine, strychnia, or the tincture of cantharides, may be administered with advantage. Of course, the doses of these agents must be apportioned to the early period of life. The sacro-lumbar region may be subjected to the influence of a cold douche every morning, or to counter-irritation, occasionally, by blistering. Any source of intestinal irritation, as worms, must be removed; masturbation, if practised, should be prevented, if possible; and acidity of the urine corrected. Under this course of treatment, the child, who previously had wetted his bed perhaps every night, may at length retain his water; care being taken not to allow the whole night to pass without seeing that the little patient's bladder is relieved voluntarily. With proper management, the child will, after puberty, generally outgrow the complaint.

In *Adults*.—*Catheterism*, to relieve the distended bladder, is always the primary indication of treatment. Remedial measures must have reference especially to the causes of incontinence. In cases of an incurable character, a urinal may be worn with great comfort.

Urinary Abscess.—Suppuration circumscribed by plastic matter, forming an abscess, is liable to occur close to the urethra in some part of its extent. It may arise from any source of *urethral irritation*; usually the collection of urine in the dilatation behind a stricture, or from urethritis, or simply from irritation of the passage by the use of instruments.

Urinary abscess is liable to form in various situations, in relation to the urethral tract; and it is thence designated *perineal*, *scrotal*, *intro-pubic*, and *ante-scrotal* or *penile*. This also represents the order of frequency in the situations of such abscess.

SYMPTOMS.—A small, circumscribed, hard, and painful tumour is felt, in the neighbourhood of the urethra (Fig. 147), which scarcely attains

any considerable size, unless in the perinæum. It is not attended by much constitutional disturbance.

TREATMENT.—Early incision is absolutely necessary, to prevent further extravasation of urine, or the formation of urinary fistula. A free and often deep incision, in the middle line, will give instant relief to tension or afford exit to matter. The part should then be well poulticed.

Urinary Fistulæ commonly result from urinary abscess, communicating with the urethra, and *externally*. The internal opening is generally in the membranous urethra, just behind the usual seat of stricture; the external opening is most frequently *perineal* or *scrotal*; and the intervening parts are traversed by the fistulous passage or passages in various and often devious routes. Sometimes the fistula is ante-scrotal or *penile*; and here the communication with the internal or urethral opening is almost direct. Less frequently, the openings of urinary fistulæ are found in the groins, the upper part of the thighs, the adjacent part of the nates, or even above the pubic symphysis. In size, the fistulous passages differ considerably; some admitting only the finest probe, others readily the finger. In point of number also, they vary remarkably; penile fistulæ being usually single, whereas scrotal and especially perineal fistulæ are often numerous. The surrounding parts share the induration; the scrotum and penis becoming enormously enlarged and brawny, or almost cartilaginous.

The urine escapes, partly at least, by the fistulous opening or openings; in the latter condition, the urine spurting out perhaps as if it were issuing from the rose of a watering-pot.

TREATMENT.—When a *stricture*, followed by abscess, is the cause of the fistula, the primary indication of treatment will be the removal of that condition. This may be done in the usual manner; by dilatation, internal urethrotomy occasionally, external urethrotomy more commonly,—and usually the perineal section, owing to the situation of the stricture. Having thus succeeded in enabling the urine to flow by the natural channel, the fistulous passages are set at *rest*, and they not unfrequently contract and close.

(1.) But *old, indurated* fistulæ are indisposed to heal, although the original cause has been thus removed. Of *stimulating applications*, various agents have been employed; in the form of injection by means of a fine syringe, as tincture of cantharides, solutions of nitrate of silver, sulphate of copper or of zinc. A probe coated with fused nitrate of silver may be passed along the tract occasionally, and this will often succeed in causing contraction. The actual cautery is sometimes curative, applied in the form of a red-hot wire, or the galvanic-wire cautery, which can be conveniently introduced along the tract before being heated by the current. *Division* of the fistulæ along their course nearly to their origin in the urethra, can be accomplished as usual, with a grooved director and narrow,

FIG. 147.*



* Roy. Coll. Surg. Mus.

blunt-pointed bistoury. Several passages may be thus thrown into one, and strips of lint should then be inserted to provoke granulation from the bottom of the tract.

During recourse to these measures for the cure of urinary fistula, any passage of urine along their course must be prevented by regularly using the catheter three or four times a day. The patient may be instructed how to do this for himself, at every call of nature.

Respecting the eligibility of these modes of treatment; in long, narrow, and tortuous fistulae, stimulation may be sufficient; when the fistulae are large and numerous, incision is more suitable, the perinaeum and scrotum being sometimes quite riddled in all directions.

(2.) *Larger-sized urethral openings*, in consequence of actual destruction of some portion of the wall of the canal, require operative interference of a plastic character, to repair the loss of substance.

URETHRO-PLASTIC OPERATIONS are designed to effect reparation in one of two ways: either by simple closure of the fistulous aperture, or by borrowing the surrounding integument to accomplish this object. These proceedings are severally applicable according to the part of the canal where the opening exists.

1. Perineal fistula may admit of closure by simply paring the edges down to the urethra, and uniting them with quilled sutures, or by Bozeman's buttons.

2. Ante-scrotal or penile fistula is much more difficult to close, owing to the want of substance in the coverings of the urethra at this part of its extent, and the liability of the part to disturbance by erection of the organ or other motion. When the opening is *small*, Dieffenbach's mode of closing it may be adopted. A sound is introduced into the urethra beyond the opening; the operator takes a small curved needle, sharp at the point but not at its sides, armed with a stout waxed silk thread, and by means of a needle-holder introduces it beneath the skin at about three lines from the border of the fistula. The needle is carried deeply, but not into the urethra, and made to emerge at another point; then dipped again, and so on by three or four stitches, carried round the opening, until it emerges at the point of entrance. The thread, thus imbedded in the cellular texture around the fistula, is drawn by its two ends together, so as to close the opening, and then fastened by a knot. In three or four days the ligature may be divided and drawn away. A *larger-sized* aperture will probably require some substitution of the surrounding skin, and this may be accomplished by Nélaton's operation, as follows:—The border of the fistula having been pared, a transverse incision is made below the fistula, with a tenotomy-knife; the blade is then passed through the incision, beneath the skin around the fistulous opening; thus forming a detached area of integument, to the extent of about an inch, which is brought together over the opening, and the edges united by a few points of fine suture.

During the course of reparation after any of these urethro-plastic operations, the urine must always be drawn off gently by a catheter, three or four times daily.

In the *female*, stricture of the urethra, and fistula, are very uncommon, and I have never met with an instance. They would, apparently, present no peculiar symptoms, nor require any special mode of treatment.

Urinary-Vaginal and Uterine Fistulæ.—Fistulous openings may be established: (1) between the urethra and vagina; (2) between the bladder and vagina; or (3) between the bladder and uterus. These communications result from contusions or laceration in parturition, the introduction of foreign bodies, the effects of calculous concretions in the bladder, or operations for their removal. Openings caused by the extension of cancerous ulceration are here omitted, as such fistulæ are quite incurable.

VESICO-VAGINAL FISTULA may be taken as the type of the three urinary fistulæ, relating to the vagina and uterus. The requisite operation consists in completely *paring* the *edges* of the vaginal aspect of the fistula, and then *uniting* them by *suture*. The patient should be in her best state of health, and the bowels have been well cleared out. Chloroform having been given, the woman is placed either on her side, with the knees well drawn up, or in the usual lithotomy position. The parts being thoroughly exposed by a duck-bill speculum, and the nates being held widely apart by an assistant, the operator proceeds to drag the opening as low down as possible, with a view to facilitate the paring of the edges. This may be accomplished by hooks, blunt or sharp; or by the introduction of a flexible sound through the urethra, which is brought out again through the fistula, and then bent backwards. This latter plan furnishes the Surgeon with a most efficient hook, and one which cannot easily slip. In paring the edges, it is necessary thoroughly to denude every part; for if the smallest portion of mucous membrane be left, it may prevent union. None of the mucous membrane of the bladder must be removed. The wound should present a *bevelled oblique* line, slanting from a large vaginal opening to a smaller vesical one. The denudation being complete and free, sutures are next to be introduced. These should be passed obliquely from at least a third of an inch outside the edge of the incision. They must *not include* the mucous membrane of the bladder. The tightening and tying of wire sutures may be accomplished by the fingers, but more effectually by means of the depressor, as used in the operation for recto-vaginal fistula. Care must be taken not to pull them too tight, so as to invert the edge of the vaginal mucous membrane.

AFTER-TREATMENT is simple. The small, double-curved silver catheter, invented by Dr. Sims, or an ordinary gum-elastic one, should be passed and retained unplugged, that the urine may continuously drain out of the bladder. This should be constantly watched; and the instrument cleansed and then reintroduced twice a day. It is of the utmost consequence to prevent the action of the bowels for at least a week; and this may be accomplished by administering a full dose of opium soon after the operation, and maintaining its influence subsequently by smaller doses. The removal of the sutures prematurely is a greater evil than their unnecessary continuance; they should certainly not be withdrawn before the *ninth* or *tenth day*, and then with great caution.

URETHRO-VAGINAL FISTULA is more easily closed by a similar procedure; but union takes place less readily, owing to the unavoidable pressure of the catheter on the line of union. This I have experienced in my own operations. It is better therefore to adopt the practice now, I believe, generally pursued; that of withdrawing the urine occasionally, by gently passing a catheter, or even to allow micturition, from time to

time, without interference. Scrupulous cleanliness should of course be observed.

VESTICO-UTERINE FISTULA is that condition wherein the fistulous communication exists between the bladder and cervix uteri. Certain modifications in the plan of operation will be required. It might become desirable to obliterate the upper part of the vagina, in order to connect the uterus with the bladder; thus allowing the menstrual fluid to pass through this organ, but preventing incontinence of urine.

These operative procedures may have to be repeated a second or third time, and even several times, in the same case; partial closure only being effected in the first instance, and afterwards more and more completely.

CAUTERIZATION has been practised for the cure of vesico-vaginal fistula, when the aperture is not only of small size, but situated so high up that the peritoneal pouch might be opened in a cutting operation. Dr. Bouqué, of Ghent, adduces, in favour of this method, the results of his experience in 35 cases; 25 of which were thus cured, 4 relieved, and 3 died—a high mortality.

CHAPTER LV.

DISEASES OF THE PENIS.

(1.) **Balanitis**.—Inflammation of the thin mucous membrane of the prepuce and glans penis is attended with some redness and smarting, and a profuse, thin, opalescent, mucus-purulent discharge, with some infiltration of the prepuce bordering on phimosis. Excoriation is apt to occur. When the mucous membrane of the prepuce is primarily affected, the inflammation is known as *Posthitis*; but this soon merges into balanitis. The inguinal glands may become slightly enlarged, but soft and tender,—a simple adenitis, and resembling incipient chancroidal bubo, but rarely proceeding to suppuration. Repeated or chronic balanitis results in some thickening of the prepuce, and tendency to warty excrescences on its mucous surface. The prepuce is not unfrequently long and redundant, a condition which seems to predispose to balanitis.

This inflammatory affection is usually the result of local irritation; from gonorrhoeal discharge frequently, and hence named "external" gonorrhoea, or simply from want of cleanliness; but it also arises in young and delicate boys, from *disordered health*, or perhaps in gusty *altos*, and during hot weather. Under one or other of these various causative conditions, balanitis often returns.

The **TREATMENT** is chiefly topical; a slightly *astringent* wash, as lead lotion or lime-water, or slight pencilling with nitrate of silver, especially in the groove around the corona glandis. Saline, cooling medicine may also sometimes be given with advantage.

CHRONIC BALANITIS—unattended with much redness and smarting—often induces a fleshy, rough, or granular thickening of the preputial mucous membrane, and the discharge is still abundant. In this state,

the membrane may be dusted with a mixed powder of calomel and calcined magnesia. When conjoined with phimosis, astringent injections must be used beneath the prepuce, which cannot then be uncovered.

A persistent tendency to balanitis, induced by a long prepuce, can perhaps be overcome by keeping the prepuce constantly retracted; this being accomplished by the application of a strip of plaster around the penis, behind the glans. In the course of a few weeks, the exposed mucous surface becomes hardened, and the foreskin often remains retracted. Failing this result, the superfluous integument should be removed by *circumcision*.

(2.) *Herpes* of the prepuce and glans penis presents the usual appearance of vesicles, clustered on reddish patches of the mucous membrane or skin, accompanied with some feeling of heat and itching. When under cover of the preputial skin, the vesicles, bursting and discharging their opalescent serum, do not dry up, but settle into small ulcerations. From want of cleanliness, or an enfeebled state of health, these excoriations may deepen, and be attended with œdematous swelling; while suppurating inguinal bubo ensues.

In the *DIAGNOSIS* of herpes, it will be observed that *vesicles* precede the small, superficial ulcerations, which otherwise might be the offspring of balanitis; and both these inflammatory affections of the prepuce and glans may be distinguished from *gonorrhœa*, by seeing whether the discharge issues from under the prepuce or from the urethral orifice.

Like balanitis, herpes preputialis proceeds from the retention of secretion beneath the foreskin, or from any irritant discharge; but it may be symptomatic of feeble health, or a gouty diathesis.

The affection is prone to recur, and perhaps as a periodic attack.

TREATMENT comprises slightly *astringent* lotions, as of lead, zinc, or tannin, applied by means of a sufficiently broad strip of lint wrapped around the glans, over which the prepuce is drawn. Thus the surfaces are intercepted and friction prevented. At the same time, constitutional treatment must not be overlooked.

(3.) *Phimosis*.—By this term is meant a *contracted* state of the orifice of the prepuce or foreskin, whereby the glans cannot be uncovered completely, if at all; the orifice being reduced to even a pin-hole opening. This condition of the prepuce may be congenital, or acquired; and these two modes of origin sometimes co-exist.

1. *CONGENITAL PHIMOSIS*, a not uncommon defect, is associated usually with an elongated and redundant state of the preputial skin, so as to project beyond the glans; but the mucous membrane is deficient, and thus prevents retraction. Adhesions sometimes exist between the opposed surfaces of this undeveloped membrane and the glans; and the glans itself is small, owing apparently to the restriction offered by the prepuce to its development.

A source of inconvenience only at first, phimosis gives rise eventually to symptoms of *vesical irritability*, incontinence, and even to retention of urine; or often to priapism and symptoms simulating *stone* in the bladder. In all such cases, the straining micturition begets a tendency to prolapsus of the bowel. By the accumulation of sebaceous preputial secretion, irritation and inflammation of the part, or balanitis, is apt to arise; and in after-life, sexual intercourse may be rendered abortive by the contracted

prepuce retaining the emitted semen. Impotency might then be suspected. *Spermatorrhœa* is sometimes provoked by phimosis. In the event of gonorrhœal or syphilitic infection, the preputial condition more or less conceals the nature of the case, and interferes with the local treatment.

2. ACQUIRED PHIMOSIS is the result of repeated *balanitis* and thickening of the prepuce, or of *chancre* with induration, or of *chancroid*, resulting in cicatrization and contraction,—especially when seated near the orifice of the prepuce.

TREATMENT.—The cause and the degree of phimosis will indicate whether the remedial measures should be operative or not. In *acquired* phimosis, an acutely inflamed state of the prepuce, or an unhealthy sore—such as chancroid—forbids operative interference, lest the wound should become unhealthy. Preputial injections may be used, and when the causative condition has been subdued, any resulting induration and contraction—as from chronic inflammation—will probably gradually disappear. But if the contracted prepuce conceals the nature of a sore; or if, this having a destructive character, as a phagedænic or sloughing ulcer, the requisite applications cannot be made; then an operation is at once necessary to expose the sore for its treatment, though not to relieve the contraction. In *congenital* phimosis, an operation may always be performed, for the sake of convenience and cleanliness; unless the prepuce can be retracted with tolerable facility for either purpose. This, however, is usually the tightest form of phimosis, and where the prepuce is also redundant. In the *infant*, when the prepuce can be retracted sufficiently to see the glans, an anxious mother may be assured that the orifice will enlarge as the organ grows. But if the prepuce distends, from the retention of urine within its cavity, during micturition, this constant source of irritation will render operation advisable.

The OPERATIONS for phimosis are of two kinds; the contracted prepuce may be slit up, or circumcision may be performed. Both operations are sometimes requisite.

Slitting up of the Prepuce.—A grooved director is introduced between the prepuce and glans, and moved round to the front so as to know that it is not in the urethra; a narrow, curved, sharp-pointed bistoury is then passed along the groove and thrust through the prepuce, dividing it as the knife is withdrawn outwards (Fig. 148). The mucous membrane and the skin should be severed to an equal extent, but the incision need not be usually more than half an inch in length, the contraction being at the orifice of the prepuce. Two or three points of suture will be necessary to bring the

mucous membrane and skin together, in each half of the prepuce; and thus promote union by adhesion. If this be not done, the skin and membrane become separated by considerable swelling after the operation, and heal by granulation,—a slower process, and which leaves a thickened margin to either flap of the prepuce. I am accustomed to

FIG. 148.



modify this simple operation to a procedure yet more simple; I divide only the mucous membrane, and retract the prepuce as the knife is withdrawn; thereby unsheathing the glans to the requisite extent for its complete release. A blunt-pointed bistoury or a concealed knife may be used; the latter instrument being sufficient for the operation without a director. Of course, no sutures are required.

Circumcision.—Any adhesions to the glans should be detached by running a probe round beneath the preputial integument; then, the prepuce must be drawn well forwards from its orifice, until that portion which corresponds to the back of the glans is brought in front of it; the projecting prepuce is seized immediately in front of the glans with a pair of narrow-bladed forceps, and held by an assistant; when the free portion of the prepuce—already placed on the stretch—is severed just in front of the forceps by one stroke of a bistoury. On removing the forceps, the mucous membrane will be seen embracing the glans, and this must be snipped up with a pair of blunt-pointed scissors, sufficiently to uncover the glans; and the frænum also snipped across if necessary. If only the portion of cutaneous integument in front of the preputial orifice was drawn forwards, the retraction will show that a belt of skin has been excised,—exposing the mucous membrane on the glans, and leaving a ring of skin adjoining the orifice. Any small arteries, on either side, and one or two near the frænum, must be secured by ligature or torsion; for, although bleeding slightly at the time, these vessels are apt to be the source of profuse hæmorrhage afterwards, even to the amount of three or four pints of blood. A few points of suture—five or six—should then be inserted to unite the mucous and cutaneous margins around the circular incision.

(4.) *Paraphimosis.*—In this—the opposite condition to phimosis—the prepuce is in a forcibly *retracted* state behind the corona glandis, whereby the glans cannot be covered. The constricting preputial orifice soon becomes the source of strangulation; resulting in swelling of the prepuce, which encloses and buries the seat of stricture in a deep furrow, with a roll or collar of the swollen prepuce in front and behind; congestion and swelling of the glans are superadded; and thus the reduction is rendered proportionately difficult or impossible. Most severe pain attends this state, increasing to torture; and ulceration and extensive sloughing are apt to follow.

Paraphimosis occurs most commonly in boys; or in adults, who, having naturally a narrow preputial orifice, or tendency to phimosis, happen to have allowed the prepuce to remain drawn back for a while. An acutely inflamed and oedematous or an indurated state of the prepuce, when retracted, will also tend to induce constriction; and paraphimosis not unfrequently arises in this way from balanitis, gonorrhœa, or chancre, or from chancre.

TREATMENT.—*Reduction* should be effected without delay. Any cold or astringent applications are of little avail, the source of constriction and strangulation still remaining. Chloroform may sometimes be administered, as the reduction by manipulative compression is necessarily painful, and of some duration. Then the Surgeon takes the body of the penis between his forefingers, just behind the swollen prepuce; he compresses and pushes back the glans with his thumbs, at the same time drawing

the prepuce forwards, which slowly rolls over the plane as this disappears (Fig. 149). There will still be a tendency to retraction, so that a little continuous advancement of the whole end of the organ, for a minute or two, may be advisable. In ninety-nine cases out of a hundred, this method of treatment will prove successful.

When reduction cannot be effected by this procedure, after fair trial,

FIG. 149.



the stricture must be divided. This is done by separating the two swollen folds of the prepuce to reach the circular constriction, in the furrow between them; and then dividing it with the point of a narrow bistoury on each side of the middle line, thus avoiding the dorsal vessels of the penis. It may be requisite to make a few punctures in the swollen preputial folds to evacuate serous fluid, before reduction can be accomplished. And perhaps also, the effusion having become partly consolidated, the prepuce cannot be drawn forwards; although the stricture has been divided. But, in a few days, the swelling subsides by absorption, and then reduction becomes easy.

3. Wart or Vegetations.—The mucous membrane of the prepuce is sometimes the seat of warty growths—*papillary hypertrophy*, which may be either chronic—as the result of long-continued irritation from various causes, or that of a syphilitic ulcer; or, indeed, from any kind of irritation. The mucous matter accumulating under the prepuce, and in the folds of the foreskin, as easily in the furrow around the corona, and in the sulcus, will discharge, they appear as soft spongy growths, of various heights, flattened when under the prepuce, and elevated when it is retracted. Several warty growths, of various sizes, may be seen, the dark growth is a cauliflower appearance. Sometimes they are situated upon the cutaneous surface of the prepuce, or on the skin around the anus; they are here believed with some probability to be venereal, but have a firmer consistence than warts of the skin. In other situations they may be distinguished from venereal warts, especially by their papillary character, and from epithelioma, by the absence of the absence of hard or circumferential induration, and of the tendency to ulcerate.

When the warty growths are numerous, and treatment with the cautery is not successful, they may be cut off with curved scissors, and the surface covered with a powder consisting of equal parts of calomel and starch.

Cancer of the Penis occurs in two forms: Scirrhous, and Epithelioma. The scirrhous form of these diseases presents nothing peculiar. Scirrhous cancer is a hard tumour in the groove under the glans, and on the inner surface of the organ. Its progression seems to be very slow, and it is not common. **EPITHELIOMA** of the penis. Professor Blandin, however, the only form of cancer of the penis. It commences

usually on the *glans*, as a *firm, warty elevation*, having a broad and somewhat hard base. At first painless and covered with a cuticular crust, this being shed or rubbed off, the growth becomes painful, bleeds a little, and soon ulcerates, discharging a thin, fetid sanguineous fluid. The *ulcer* has the usual characters,—presenting a more or less deep and granular surface, with an everted and indurated margin. Sometimes, an *exuberant, granular* mass sprouts up, which discharges the same fetid, sanious fluid, or which readily bleeds. But the ulceration—preceded by epithelial infiltration and induration—spreads, in depth and circumferentially, destroying the *glans*, opening the urethra, and involving the prepuce. More rarely, extending back to the root of the penis, the ulceration may invade the scrotum, perinæum, and anus, or reach the pubes and groins. Long before any such advancement of the disease, the *inguinal glands* become affected, but not distant organs. Occasionally, the prepuce is the seat of this form of cancer. Phimosis here also seems to be a predisposing condition; and the prepuce may be ulcerated through, disclosing the cancerous growth. Sooner or later, the patient succumbs from pain and prolonged discharge,—dying exhausted.

DIAGNOSIS.—In the early stage of cancer, there may be some difficulty in distinguishing between a *cancerous wart* and a *common wart*, or *chancreous* induration which has not ulcerated or has cicatrized. But the ulcerative tendency of cancer, and the character of the discharge, with the slow, steady progress of the disease, are diagnostic. The somewhat advanced period of life, and the negative effect of treatment, will also corroborate the nature of the disease.

TREATMENT.—The only curative treatment is extirpation; either by circumcision, or by amputation of the organ. But operation will prove successful only in an early stage of the disease, and before the inguinal glands have become affected.

Circumcision should be selected only when the disease is strictly limited to the prepuce; a comparatively rare condition, whether as regards the origin of cancer of the penis, or the stage when this affection usually comes under surgical treatment.

Amputation of the Penis.—This is a very simple operation, yet certain particulars must be observed to insure its satisfactory performance. Amputation may be effected by the knife, or the *écraseur*; the former instrument being generally preferable. The operation should always be performed near the root of the penis, in order to completely remove the disease. An assistant holds that part of the organ firmly between the thumb and finger, to prevent the liability of its slipping back under the pubes, and to restrain hæmorrhage; then the Surgeon, laying hold of the penis, draws the integument slightly forward, and severs the body of the organ near its root by one sweep of the knife from above downwards. If too much integument be drawn over the stump, it may overlay the urethral orifice; if too little, an inconvenient puckering results. Bleeding vessels are then to be secured; usually, five arteries require ligation,—the two dorsal arteries, the artery of the *corpus cavernosum* on each side, and one in the septum. The oozing surface of the *corpora cavernosa* will spontaneously cease to bleed, aided by sponging with cold water; or such hæmorrhage may be restrained by a compress, secured by a T-bandage. A tendency to retraction of the stump under

the public and must not be overlooked, and a catheter should then be kept in the bladder to insure a free escape of the urine. Granulation and contraction close the wound, the skin becoming puckered around the urethral orifice. During and after this process of healing, this orifice has a tendency to contract, resulting in stricture of a most troublesome or even fatal character. To prevent any such result, a catheter should be introduced and kept in the bladder; the silver female catheter, or a gum-elastic one, may be used now that the urethral passage is so much shortened. When an instrument is not easily borne, Mr. Teale's little addition to the operation will be convenient; a catheter is introduced, and the urethra and adjoining skin are slit up with a bistoury to the extent of about one-third of an inch. A single suture is then placed on each side of the slit, uniting the skin and mucous membrane.

After amputation of the penis, the stream of urine is projected downwards between the legs; and this inconvenience may be avoided, as Part suggested, by wearing a short funnel, adapted to the pubes over the osoma, whereby the urine is carried away from the person.

Malformations.—Deficiency of a part of the urethra, laying open the canal from the external meatus, is a not uncommon malformation. It is a congenital condition by arrest of development.

Eversionism, the most frequent form, is that condition wherein the under part or floor of the urethra is wanting; to the extent usually of the glans, or sometimes as far back as the root of the penis. Through this under fissure, the urine is passed somewhat inconveniently, and the women is viewed in an unsatisfactory manner during sexual intercourse. When the fissure passes some way back, it may be impracticable to eject the semen into the vagina.

Epispadias signifies the opposite condition: that wherein the upper part, or roof of the urethra is wanting, to a variable extent from the meatus, together with a corresponding portion of the glans and of the osoma, together with the osoma cavernosa. The upper fissure is, perhaps, more open than an under fissure; but epispadias is usually less extensive, unless it is connected with extrusion of the bladder, and it is certainly a much less common form of urethral deficiency.

CHAPTER LVI.

DISEASES OF THE SCROTUM, TESTIS, AND CORD.

The Testicles, with the Spermatic Cords, and the Coverings of these bodies, are subject to numerous Diseases, the nature of which should be well understood; as, owing to their contiguity, they require a careful diagnosis, and in consideration of their frequency and importance, they demand attentive study, with a view to effectual treatment.

SCROTUM.—(1.) **Inflammatory Oedema** of the scrotal integument is an affection of an erysipelatous character; and, owing to the loose structure of the subcuticular tissue, it is attended with great effusion and

swelling, with a marked tendency also to *rapid sloughing*. The skin becoming involved, the testicles and cords are soon exposed, and these organs may even hang pendulous, entirely bereft of integument.

DIAGNOSIS.—Scrotal oedema of this kind presents a general resemblance in appearance to the spreading swelling produced by extravasation of urine. But the extension of the scrotal swelling upwards on the abdomen, is not uniform on both sides; when an incision is made, there is no discharge of any urinary smelling fluid; and a catheter can be passed into the bladder, without encountering any obstruction, as from stricture of the urethra.

This affection is liable to occur in *enfeebled* persons, from any slight local cause of *irritation*; as a small wound, crack, or abrasion; a boil or small abscess in or near the scrotum. Sudden exposure of the part to cold, as in the act of micturition, may be followed by inflammatory oedema. Apart from the predisposing constitutional condition, sloughing of the scrotum rarely supervenes—thus also differing from urinary extravasation.

TREATMENT consists in elevation of the scrotum, with fomentations; and early free incisions, on either side of the raphé, down to the most dependent part of the swelling. Tension is thus relieved, and the tendency to sloughing. In the event of this issue, granulation and cicatrization proceed apace even after the most extensive exposure. Constitutional treatment must be conducted on ordinary principles, for sustaining the patient's strength during the consecutive processes of destruction and reparation.

Anasarca of the scrotum, in old, weak persons, should be met by puncture, rather than by incision.

Oedema of the scrotum, in newborn infants, often happens in consequence of some slight irritation of the skin. It subsides usually under careful attention to keep the part dry and powdered.

(2.) **Pediculi**, known in vulgar parlance as "crab-lice," sometimes infest the hair of the pubes and scrotum. They are easily seen, with their oblong ova attached to the hairs. These parasites are readily killed by a wash of corrosive sublimate—two or three grains to the ounce of water; or simply by sprinkling the part with calomel. Some of the pediculi have perhaps migrated to other hairy portions of the body, as the armpits, and may be exterminated by similar means.

(3.) **Elephantiasis** or **Hypertrophy** of the *scrotum* rarely occurs in this country, but is very common in tropical climates; especially China, the Indies (East and West), Egypt, and South America. It consists of a *fibroid thickening* of the scrotal integument, with *infiltration* of serum or oily matter; the latter being sometimes so abundant as to give to the whole the character of an oleaginous mass. The blood-vessels become much enlarged and varicose, so that the fibroid structure is remarkably vascular. The cremaster has been found thickened, and the spermatic cords elongated; but the testes are usually healthy. Hydrocele occasionally co-exists, or sometimes scrotal hernia. The whole mass is pendulous, and of a globular, ovoid, or pyriform shape.

TREATMENT.—In the early stage of this disease, it may perhaps be arrested by pressure and other means of allaying chronic inflammation of the skin. Sir Joseph Fayrer speaks highly of iodine, with quinine, arsenic, and iron; but that change of climate from the endemic source of

TUMOUR.—When the tumour is of moderate size, the testes and penis may be displaced and moved; the hæmorrhage not proceeding to a dangerous extent. When the tumour has attained to a large size—forty pounds in weight—it must be excised en masse, including the genital organs. The advantage of a partial excision would be so profuse as to be dangerous during the operation; and even with the rapidity of complete excision, hæmorrhage may result from loss of blood. To prevent the risk of hæmorrhage, a clamp should be applied to the neck of the tumour, or a few ligatures and the tumour may be raised for half an hour before the operation, in order to draw back the blood into the general circulation.

[illegible]

EXAMINATION OF THE TESTIS AND CORD

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TUMOURS,—Cystic, Cartilaginous, Fibrous, Cancer; (4) HYPERÆSTHESIA OF THE TESTIS, NEURALGIA; (5) CONGENITAL MALPOSITION of the Testis.

Hydrocele.—In the widest acceptance of the term, Hydrocele signifies an accumulation of serous fluid, in connection with the Testis or the Spermatic Cord.

Ordinarily, the fluid is collected in the tunica vaginalis, enveloping the testis; sometimes, in a cyst or cysts, variously situated relatively either to the testis, or in the course of the spermatic cord. Hence. Hydroceles may be divided into that of the TUNICA VAGINALIS TESTIS; and the ENCYSTED forms, as relating either to the Testis or to the Cord.

An accumulation of serous fluid in the *Tunica Vaginalis* may occur in two conditions of the sac: either when the vaginal process of peritoneum has become obliterated, whereby the fluid is contained in a distinct sac,—constituting the common form of Hydrocele; or when that tubular prolongation of peritoneum remains unobliterated, so that the fluid is contained in a sac which communicates with the general peritoneal cavity,—constituting *Congenital Hydrocele*. This occurs usually, of course, in infants or children; but sometimes also in adults,—when the vaginal process of peritoneum has remained open.

Hydrocele of the Tunica Vaginalis.—The serous fluid is accumulated in a distinct sac, enveloping the testis; and this organ, somewhat enlarged, is usually situated at the lower and back part of the sac. Sometimes the testis is flattened and spread out by constant pressure of the fluid; and the epididymis is then elongated, obliterating the pouch which naturally exists between the testis and epididymis. Or, the testicle may be separated from the back part of the sac by an increase of this pouch, which forms a second sac communicating with the general sac of the tunica vaginalis, between the testis and epididymis. Lastly, the testis may occasionally project into, and transversely across, the hydroceleic cavity; forming a septum whereby the sac is divided into two compartments. The position of the testis is sometimes changed to the lower and fore part of the sac, or it may lie wholly in front. The *serous fluid* is simply the natural secretion of the tunica vaginalis, or slightly modified by inflammation. *Clear*, and of a pale straw colour, this fluid often acquires a dark-brownish or chocolate hue, in an old hydrocele, or rarely it has a white milky colour; in both cases becoming less transparent or *opaque*. In its *composition* the fluid is albuminous, alkaline, and saline; but there may be associated—fibrine in variable proportion, as indicated by spontaneous coagulation; or red corpuscles of the blood, in a disintegrated state, when the fluid is dark coloured, reddish, brown, green, or even black, with perhaps flakes of cholesterine intermixed; or products of inflammation occasionally, as flakes of lymph. Occasionally, *spermatozoa* are found in the fluid of hydrocele; apparently from an encysted hydrocele of the testis, adjoining the tunica vaginalis, having burst into the sac, or having been punctured in tapping the vaginal sac. In point of *quantity*, the fluid of hydrocele varies from six to twelve or twenty ounces, averaging less than a fluid pint; but it may have accumulated to double or treble that amount.

SIGNS.—A collection of serous fluid in the tunica vaginalis is attended with a swelling on the affected side of the scrotum, which presents certain

distinctive characters. The swelling is at first soft and fluctuating on compression with the fingers, but it becomes denser and elastic as it is distended; it is translucent when examined by transmitted light, increasing in size according to the quantity of fluid secreted; the swelling varies in magnitude from a hen's egg to a small coco-nut; eventually it attains to a size which, dragging over the penis, reaches that organ, and extends downwards to or towards the knee. In point of shape, the swelling is at first oval; enlarging, it becomes pyriform with the bag end downwards, thus corresponding to the shape of the distended tunica vaginalis; and there is often a slight transverse constriction about the middle of the tumour, apparently due to the lower border of the cremaster muscle, which thus gives an hour-glass appearance to the hydrocele swelling. Little or no pain is experienced, only some tenderness in the testicle or epididymis; and a sense of weight or dragging down as the hydrocele enlarges.

The mode of examining a hydrocele is very simple. Having handled the swelling to ascertain its fluid character, by fluctuation or elasticity, the translucency may be shown by grasping the posterior part of the tumour, so as to render the integument of the fore part tense; then placing a lighted candle on one side of the tumour and looking through it from the opposite side, at the same time screening any direct light from the eye, by resting the hand edgewise along the front of the scrotum.

Varieties of Hydrocele are met with, in consequence of changes in the sac, or the contained fluid. These changes are chiefly found in old hydrocele. *Thickening* of the sac often takes place, the tunica vaginalis acquiring the resistance of pasteboard; sometimes it becomes cartilaginous, or even osseous by the formation of bony plates on its interior. A *lobular* or *multilocular* condition of the sac sometimes occurs; either as a result of pouch-like dilatations, or of inflammatory adhesions of the interior and the formation of septa, dividing the sac into two or more compartments. The *serous fluid* is liable to undergo the changes of colour and opacity already noticed.

Under these circumstances, the fluctuation and translucency of the tumour become less and less marked as signs of hydrocele. The test by transmitted light may, however, yet be available when the examination is conducted in a darkened room. But the brownish or blackish colour of the fluid contained in the sac, sometimes renders the tumour quite opaque.

HYDRO-SARCOCELE signifies that variety wherein the *testicle* itself is much enlarged in conjunction with hydrocele; and I have known this condition to exist on both sides.

DIAGNOSIS.—1. Hydrocele is distinguished from *scrotal hernia*,—by the translucency of the swelling, when this sign is present; by the tumour terminating *abruptly* at the external abdominal ring, instead of extending with a thick stalk upwards into the inguinal canal; by the sharp angle formed at the external ring, and hinge-like movement of the tumour, when it is tilted forwards; by the absence of impulse at that point, on coughing; by *irreducibility* of the tumour—as compared with an ordinary, or reducible, hernia; by the *lighter weight* of hydrocele; and by the history of its development, as to whether the swelling com-

menced *below*, in the scrotum, and ascended to the groin, or descended into the scrotum. 2. Hydrocele of a *hernial sac* rarely occurs; and differs from ordinary hydrocele of the tunica vaginalis, in the tumour being distinct from the testicle below, in the scrotum, and by its *extending up* to the internal abdominal ring. When purely inguinal, the tumour—thus formed—closely resembles an *encysted* hydrocele of the cord. Apart from the history of hernia, the distinction may be impossible. 3. The two conditions—*hernia* and *hydrocele*—are not unfrequently *co-existing*; the hernial sac descending into the scrotum, in front or behind the hydrocele, on one side of it, or sometimes into the hydrocele. 4. From *cystic disease of the testicle*, hydrocele may be distinguished by the fluctuation extending all over the swelling, instead of being limited to some *part* of the tumour. 5. From *hæmatocele*, or a collection of blood in the tunica vaginalis, hydrocele is known by its translucency; when non-transparent, recourse must be had to the aid of *puncture* by a trocar, as the turning-point of diagnosis. 6. Rarely, *cancerous* thickening of the tunica vaginalis is attended with an effusion of fluid into the sac, which simulates hydrocele; the *testis* itself remaining *free* of cancer-growth, this disease is unlike an enlarged testicle with hydrocele, or hydro-sarcocele.

CAUSES.—The serous fluid in the Tunica Vaginalis—forming Hydrocele—is only an excessive quantity of that which naturally moistens the internal surface of the tunic; and its accumulation results from loss of balance between secretion and absorption. This change seems to be dependent on long-continued *irritation*, and often arises from a blow or other external violence. Inflammation may also be induced in like manner; giving rise to hydrocele, and an effusion of lymph mixed with the serous fluid. Hydrocele occurs most frequently about middle life, and in persons of a weakly constitution, or an enfeebled state of health.

Loose bodies are found, occasionally, in the tunica vaginalis, which, by constant irritation, give rise to hydrocele. These bodies are analogous to loose cartilages in joints. They have an oval, flattened shape, and a smooth surface; a somewhat elastic hardness, and vary in size from a pea to a hazel-nut. Seldom more than three are present. They consist of fibro-cartilage, perhaps partly ossified. Originally pedunculated, and hanging from within the vaginal sac, these bodies become detached and freely movable; gliding about, they are readily felt, at least before the sac becomes distended with fluid.

TREATMENT.—Arrest of the secretion, and resorption of the serous fluid, in hydrocele, cannot be induced by any known medicinal treatment, topical or constitutional. In this respect, hydrocele resembles similar effusions in hydrocephalus, hydrothorax, hydrops articuli, etc.

The treatment adopted may be *Palliative*, by tapping; or *Curative*, by tapping, and the injection of some stimulating fluid to induce inflammation or inflammatory adhesion; or, as a last resource, by the introduction of a seton for the same purpose.

(1.) *Palliative Treatment*.—*Tapping* a hydrocele is performed by means of a fine trocar and cannula, in the following manner. The Surgeon having ascertained the position of the testis, usually at the lower and back part of the scrotum, he grasps the posterior part of the tumour so as to make tense the skin in front; then selecting a spot about the middle

of the projecting surface, and in an interspace between the vein, thrusts a fine trocar and cannula in a perpendicular direction backward into the hydrocele, taking care not to push the instrument so far back as to wound the testicle, when the hydrocele-sac yields suddenly before the point of the trocar (Fig. 150). The object of thus avoiding the vein, and of directly transfixing the skin and sac of the hydrocele, is to prevent any effusion of blood into the intervening cellular tissue, which might

Fig. 150.



lead to sloughing; while the testicle is avoided by observing the precautions in handling the tumour, and as to the limited depth of the instrument. On withdrawing the trocar, the fluid is drawn off through the cannula, which is then laid withdrawn, and the puncture-spot covered, if necessary, with a small piece of plaster.

The relief afforded by this procedure is, usually, only temporary; the fluid is almost certain to reaccumulate in the course of a few months,—as early as five weeks I have known twelve ounces reproduced, when the hydrocele had often been tapped previously. Tapping may then be repeated, and on several subsequent occasions, whenever requisite to relieve the weight and

inconvenience of the hydrocele. In healthy subjects and small hydroceles, palliative treatment, by a single or repeated tapping, sometimes proves a radical cure.

(2.) *Curative Treatment.*—This may be effected by means of a stimulating injection, or by the introduction of a seton. The latter method is almost discarded.

Injection.—Tapping having been performed as already described, some stimulating fluid is injected through the cannula by means of a small glass syringe. Various fluids have been used—port wine, spirits of wine, sulphate of zinc in the proportion of a drachm to the pint of water; but the most effectual kind of injection is tincture of iodine, to the amount of two or three drachms. The injection may be allowed to remain in the sac; or allowed to escape, after the lapse of a short period varying from a few minutes to half an hour, according to the practice of some Surgeons.

Two practical points should be observed in using the injection: firstly, that the slit in the cannula be completely within the tunica vaginalis, before throwing in the fluid; secondly, while withdrawing the cannula, the sac should be nipped against it between the finger and the thumb. Both these precautions are with the view of preventing any escape of the fluid into the cellular tissue between the skin and sac; an accident which would probably be followed by diffuse inflammation and sloughing, particularly in a weakly patient.

The immediate effects of injection are more or less severe; pain,

extending up the cord into the abdomen, and perhaps attended with faintness.

After-treatment is simple. The patient should rest for a few days. In the course of twenty-four hours, inflammatory effusion will have taken place into the sac, and the swelling may be reproduced to nearly its original size, looking almost as if the hydrocele had not been tapped. This is a good sign, announcing the probability of a radical cure ensuing. The degree of pain produced is no criterion of the curative efficacy of injection. At the time of operation, sudden and severe pain may be excited immediately the stimulating fluid touches the tunica vaginalis, and which becomes excruciating; yet without much, if any, inflammation being induced. Conversely, there may be little pain and much inflammation. According to the degree of inflammatory swelling produced, it will be necessary to regulate the process; by handling the scrotum on the affected side to promote effusion, or by cold lotions to moderate it. *Orchitis*, to some extent, accompanies the inflammatory effusion within the sac; thus presenting a mixed swelling, oedematous to the touch superficially, hard and tense when felt deeper. In a few days, also, as the scrotal swelling subsides, that of the testicle becomes more obvious. A dry friction-sound can often be elicited when the interior of the tunica vaginalis comes in contact; and a permanent cure results in a month or six weeks. *Double hydrocele* may be tapped, but not injected, at the same time.

In certain *exceptional* conditions, local and constitutional, the radical cure of hydrocele should not be resorted to. *Large* hydroceles—one, for example, containing a quart of fluid—should not be injected; the consequent inflammation of so large a sac might prove overwhelming and terminate fatally. Such a hydrocele may be tapped; and in a short time emptied again, when the sac has become contracted; and then this smaller-sized sac can be safely and effectually injected. A *thick-walled* hydrocele, with perhaps ossific deposit on the interior of the tunica vaginalis, can scarcely be cured, but is apt to suppurate from a stimulant injection. Or, when the fluid is bloody or *purulent*, this condition is unfavourable for adhesion or an arrest of secretion. Hydrocele depending on enlargement of the testicle—*hydro-sarcocoele*—is incurable by injection,—the disease of the organ, whether syphilitic or scrofulous, remaining as the cause of resecretion of fluid in the sac. An enfeebled state of health, or persons *advanced in life*, should not be subjected to the risk incurred by injection. Tapping may be resorted to as occasion requires.

In these and other conditions adverse to the radical cure by injection, the tunica vaginalis may be laid open by *incision*, under *antiseptic* precautions. The tunica is united to the scrotal integument, by carbolized sutures, and a drainage-tube inserted. This method of treatment has been practised with safety and success, resulting in a permanent cure.

In *children*, *external* irritation, by means of some *stimulant application* to the scrotal integument, will often suffice to cure a hydrocele. Tincture of iodine, diluted with an equal proportion of water, answers the purpose; or any gently stimulant lotion or ointment may be employed.

Congenital Hydrocele presents a few points of importance with regard to its Diagnosis and Treatment.

DIAGNOSIS.—The vaginal process of peritoneum remaining open, as a

remarkable for abounding in *spermatozoa*. In both these particulars, the fluid of encysted hydrocele *differs* from that of ordinary hydrocele. When this cyst projects into the tunica vaginalis, simulating common hydrocele, the only possible distinction may be the nature of the encysted fluid, as shown by *puncturing* with a trocar. From containing spermatozoa, encysted hydrocele is sometimes named *spermatocele*. A tumour of slightly *solid* consistence might yield the sensation of a cyst; a myxoma of the epididymis.

TREATMENT is precisely the same as that already described. The radical cure, by iodine *injection*, is not so uniformly successful as in ordinary hydrocele; but, if it fail, *incision* of the cyst has been recommended, in order that it may granulate from the bottom and thus become obliterated. Encysted hydrocele may sometimes be left alone; the cyst attaining to a certain size, and then remaining stationary for years.

Encysted hydrocele may be conjoined with an ordinary hydrocele of the *Tunica Vaginalis*, forming a *bilobed* tumour or swelling; but having an elastic, fluctuating character.

Hydrocele of the Spermatic Cord.—

This form of hydrocele is characterized by the presence of a *cyst*, containing serous fluid; and situated in some part of the *spermatic cord* (Fig. 152). It occurs, usually, between the *external abdominal ring* and the *testicle*; but it may be found within the inguinal canal and near the internal abdominal ring, or at any intermediate point. But the cyst is always *distinct* from the testicle or the tunica vaginalis.

The SIGNS are those of a round or oval tumour, rarely attaining to a larger size than a hen's egg; *elastic*, and *translucent* when it can be examined by transmitted light. The swelling is painless. It is movable, unaffected by compression, and receives no impulse on coughing; unless situated in the inguinal canal, when—owing to its mobility up and down the canal, according to the recumbent or standing position of the patient—the *apparent* diminution under compression, and some impulse on coughing, will render the *diagnosis* from *inguinal hernia* difficult. The *return* of the tumour in any position of the patient, chiefly distinguishes it from hernial protrusion. But even this distinction fails in the diagnosis from an *irreducible hernia*.

The formation of any such cyst in the spermatic cord seems to be generally due to an unobliterated portion of the vaginal sheath of peritoneum which accompanies the cord; and which, at that part, becomes distended by an accumulation of fluid in it. Sometimes the cyst arises as a distinct cystic formation, connected with the cord. Hydrocele of the cord occurs most frequently in children or young boys; although it may be met with at all ages.

TREATMENT should be conducted on the same principles as for other

* Roy. Coll. Surg. Mus.

FIG. 152.*



...grasping of stimulating injection, or the introduction of a
...to induce granulation from the bottom of the cyst.
...Hydatids of the Ovary has been described by Pott and
...as a variety of hydatids, has found its way into Scapular
...It is, however, it is probably, simply an extension of the cyst,
...of the ovum.

Treatment would have to be conducted on ordinary principles;
removal by ligature, or incision of any localized swelling to
bring out the contents.

Chylous ... it is that condition in which the
...of peritoneum retains a serous
...; instead of being closed as a
...of the cyst. Serous fluid
...cyst, constituting the hydatid
...in the serosa. The swelling
...distensible by compression, more or
...the abdominal aperture. To dis-
...from ligamentous bands may,
...some transudation of the

The only available treatment would be to try to obliterate the
abdominal communication by the application of a truss, as for the cure
of *Chylous* ...

Hydatids of the spermatic Cord may be emptied with *Figured
Syringe*. The fluid as it slips into the hydatids of the cord;
thus forming two sacs to the hernia, that
of the hydatid being opened first is the
course of an operation.



Hematocoele.—By Hematocoele is
meant an effusion of blood into the *Truncus
Ventriculi*, or into a Cyst connected with the
Ventricle or Cord—*Excystis* hematocoele.

The effused blood varies in quantity
and condition. In the latter respect, the
blood may be a sanguineo-serous fluid, or
pure blood. It may be clotted, mingled
with fluid, or become uniformly coagulated
and laminated in layers, as in an an-
terial sac. Or, the coagula have under-
gone various states of decomposition and
disintegration. The containing tunic or
cyst usually becomes thickened, perhaps to
a considerable extent, amounting even to
an inch in thickness, and involving the
surrounding cellular texture; as the result
of inflammation induced by the presence of
effused blood. In hematocoele of the *truncus
ventriculi* (Fig. 153), this thickening in-
volves the tunic, although stretched from constant pressure by the

* See also the tunic atrophied, but not the substance of the tunic,
the tunic healthy; although stretched from constant pressure by the

distended sac, or by the contraction of its own thickened tunic. Lymph is sometimes effused as a product of inflammation, on the inner surface of the tunica vaginalis, there being mingled with the blood.

The CAUSE of Hæmatocele is *traumatic*; a blow or squeeze of the testicle; a strain, as affecting the cord; or other mode of violence. In hæmatocele of the tunica vaginalis, the source of the blood is some ruptured vein in the tunic, or small rent in this membrane, or it may be a wound of a vessel in tapping hydrocele. *Spontaneous* hæmatocele is also said to occur, apparently from rupture of an enlarged spermatic vein; or from an hæmorrhagic tendency, as in scurvy.

In hæmatocele of the Cord, rupture of an enlarged spermatic vein is the source of effusion.

Hæmatocele of the Tunica Vaginalis.—An effusion of blood into the tunica vaginalis may occur as an original affection, or supervene upon hydrocele.

SIGNS.—In both cases a swelling is presented, which slowly and gradually increases in size, until it attains to that of a duck's egg or a cocoa-nut, or even to that of a melon. The swelling is more or less *fluctuating* and *opaque*. Sometimes ecchymosis of the *scrotum* is produced, whereby the tumour has a characteristic dark-coloured or black appearance, which, however, gradually disappears.

DIAGNOSIS.—1. When Hæmatocele is a primary affection, its *sudden appearance* is distinctive, especially when the swelling is known to have immediately followed a *blow*, and is not the product of inflammation. When a *Hydrocele* suddenly enlarges and loses its transparency, an effusion of blood has probably taken place. The absence of translucency might, however, be due to some brownish opacity of the fluid, or to a thickened state of the tunica vaginalis—as often occurs in old hydrocele. *Ecchymosis* of the scrotum, in any case, will confirm the diagnosis. 2. *Chronic* hæmatocele, and without any ecchymosis, may be mistaken for other tumours in the scrotum. The diagnosis must then be determined by the distinctness of fluctuation, the rate of increase of the swelling, and its cause. *Cancer* of the testicle is apt to be mistaken for hæmatocele; in numerous instances, malignant testis has been opened for hæmatocele; and the more serious error has been committed of removing an hæmatocele for malignant disease. The most constant distinction is the *steadily increasing growth* of cancer; whereas hæmatocele sometimes ceases to enlarge, or even diminishes in size. *Puncture* of the tumour, with a trocar and cannula, should always be resorted to as the turning-point of diagnosis, before proceeding to remove the testicle.

TREATMENT.—(1.) In *recent* hæmatocele, and where the blood yet remains fluid, *absorption* may, perhaps, be induced; by rest, cold lotions, or leeches, according to the inflammatory state of this affection. Even when hæmatocele supervenes on hydrocele, this treatment has proved effectual, without any operative interference.

(2.) In more *advanced* and *chronic* hæmatocele, the state of the blood, as being fluid or solidified, will mainly indicate the requisite operative procedure. (a.) *Fluid* blood can be evacuated by *tapping*; and with iodine *injection* may be a radical cure, as in hydrocele. *Antiseptic* syringing, and drainage, will be as effectual, and is a safer method of treatment for a hæmatocele of large size. As in hydrocele, the variable position of

the testicle should be remembered in puncturing the tunica vaginalis. Commonly situated at the back of the sac, the testis was found in front, and was wounded, in two cases recorded by Mr Curling. (b.) *Solidified*, or firmly coagulated blood, cannot be evacuated by puncture; it will then become necessary to make a *free incision* so as to lay the tunica vaginalis entirely open, to turn out the clots, and wash it out thoroughly by antiseptic syringing. Otherwise, any remnant blood undergoing decomposition in the sac, sloughing and systemic infection are liable to result. Profuse hæmorrhage has, however, been known to follow free incision; a source of danger which cannot be avoided.

When the hæmatocele has attained a very large size, and the tunica vaginalis has become much thickened, castration, in order to remove the entire mass with the testicle, may be the safest procedure. This will be specially advisable in elderly persons.

Encysted Hæmatocele of the Testis, or of the Cord.—*Cysts*, containing blood, are occasionally met with; both in connection with the testis and the spermatic cord.

FIG. 154.*



In connection with the **TESTIS**, it may be difficult or impossible to distinguish encysted hæmatocele from ordinary hæmatocele of the tunica vaginalis. **HÆMATOCELE OF THE CORD**, arising from a strain or other violent exertion, presents a cystic swelling in some portion of the spermatic cord; but it is always *distinct* from the testicle or the tunica vaginalis (Fig. 154). Commencing usually within the *inguinal canal*, the tumour has a round or oblong shape; and, increasing in size, it extends downwards through the external ring into the scrotum, where it may attain an enormous size. The swelling is *semi-elastic*, but *opaque*, when of sufficient size to be examined by transmitted light. As in hydrocele of the cord, hæmatocele of the cord is movable, unaffected by compression, and receives no impulse on coughing. These characters *distinguish* it from *inguinal hernia*, unless when situated within the inguinal canal, where the diagnosis is often most difficult.

TREATMENT.—(1.) In the recent condition of Encysted Hæmatocele,—the blood remaining as yet fluid,—remedial measures may be directed to promote absorption, by rest and evaporating lotions. An incision, in this state of the hæmatocele, might lead to fearful hæmorrhage from the ruptured vein.

(2.) In an *advanced* condition, the mode of treatment must vary according to the fluid or solidified state of the blood. *Tapping*, or coupled with iodine *injection*, will now become appropriate; or an *incision*, to turn out the coagula, in order that the cyst may granulate and heal from the bottom.

Varicocele.—An enlarged and varicose condition of the spermatic veins, known as Varicocele or Cirsocele, is attended with certain marked characters.

SIGNS.—A *swelling*, of an ovoid or pyramidal shape, with its base downwards, forms between the *testicle* and *external abdominal ring*; usually on the left side of the scrotum. This swelling feels knobbed and

* Roy. Coll. Surg. Mns.

convoluted; slipping about between the fingers as if it were a *bundle of worms* (Fig. 155). It is *inelastic* and *compressible*, but the swelling gives a slight impulse on coughing, and it slowly diminishes in the recumbent posture, reappearing in the erect position and increasing after long standing, although moderate pressure be maintained on the external ring. The enlarged veins may often be seen through the thin scrotal skin, which hangs relaxed, and presents, perhaps, an arborescent enlargement of its veins. There is little or no pain, but a sense of tension and weight, which is at once relieved when the patient lies down. Sometimes the swelling becomes temporarily painful, the pain assuming even a neuralgic character, apparently from compression of some branch of nerve, when the varicocele is recent, and rapidly formed, although without having attained to any notable size. The *testicle* becomes more or less atrophied, and, when much reduced in size, it may be almost concealed beneath a large varicocele. Double varicocele very rarely occurs, and that on the left side is even then the most developed.

FIG. 155.*



The **DIAGNOSIS** of varicocele from *scrotal hernia* may be readily determined by the peculiar feel of the swelling, although both the tumours have some resemblance; varicocele is less affected by coughing and by recumbency, and although reducible, the *swelling slowly returns* when the external ring is nearly occluded with the finger,—as the spermatic veins refill from below upwards. From *hydrocele* of the *tunica vaginalis*, or of the *cord*, varicocele differs in having all these characters; and as regards the former hydrocelic affection, varicocele has the additional distinction that it does not extend down to the testicle so as to envelop this organ.

In connection with a large varicocele, the veins of the *scrotum* are often dilated. But a varicose state of the scrotal veins may also occur as an independent affection; particularly in advanced age, rather than in youth, when varicocele is common. The scrotum is beset with numerous dark-red spots, not larger than from a pin's head to a pea, and which disappear for a moment, under pressure with the finger. They are plainly dilatations of small veins.

* Royal Free Hospital. (Author.)

CAUSES.—In respect to age, varicose commences usually at not eighteen or twenty, very rarely before puberty, although I have seen one case; and when commencing after thirty or forty-five, it is generally the result of injury or continued pressure on the part. In age advanced, the enlarged veins evince a tendency to diminution. Varicose is found in about one male adult in ten. The exciting cause may be any exertion which tells upon the spermatic veins, as exerting at stool, long riding, exercise, standing or sitting. Any such exertion having induced varicose will also aggravate it from time to time.

TREATMENT.—*Palliative* treatment consists in wearing a well-suspensory bandage or an elastic bag, to support and slightly compress the enlarged veins, or a well-adjusted truss, with the pad upon the external ring, to prevent any sudden reflux of blood into the veins during exercise.

During any occasional period of pain or tenderness in the affected veins, the recumbent posture and rest, a cold evaporating lotion, and saline aperients will give relief.

Curative treatment.—Obiteration of the enlarged and varicose vein has been attempted by various operative procedures.

(1.) The method most frequently practised is—compression at two

FIG. 156.



points, by two-pin pins and twisted suture, with subsequent subcutaneous division. (H. Le.)

The operation is performed in precisely the same way as in varicose veins in the leg (Fig. 156); care being taken to exclude the vas deferens, which is easily recognised by its firm, non-whiplash character. The whole of the veins should not be included, and the spermatic artery should be excluded, a precaution easily observed by keeping to the side of the vas deferens, near which the artery lies. The pins may be removed in a week or ten days, before ulceration or sloughing ensues,—which is less liable

to happen when the sutures have been only tight enough to stop the vein, without unduly compressing the integument. Should the artery have been included in the compression, hæmorrhage is apt to occur when the pins are withdrawn. In one such case, within my own experience, the loss of blood was controlled by acupressure of the vessel.

(2.) *Bland's subcutaneous ligature* is thus described by Mr. Curling:—The vas deferens being separated from the mass of veins, and the latter being pinched up with a fold of the scrotum, a needle set in a handle, with an eye near the point, armed with a double-looped thread, is to be passed beneath them. When the needle has traversed from one side to the other, the loop is to be drawn out, the needle retracted, and the veins let go, the skin alone being now held up. A second needle, similarly armed, is then to be passed through, over the veins, entering at the same aperture by

which the first needle was thrust out, and emerging at the same aperture by which it entered. The second loop is next to be drawn out, and the needle withdrawn. The bundle of veins is thus included between two threads, one passing over and the other beneath it. The ends of the thread on each side are then to be passed into the loop of the other, and by drawing these ends in opposite directions, the veins are tied beneath the skin. The vessels become divided, and the ligatures separate from the tenth to the twentieth day.

These operative procedures have been variable in their *results*. Great relief or a cure has been effected in several instances. On the other hand, no good has been produced, the operation proving abortive; or only a temporary cure has resulted, the varicocele returning at no distant period. Diffuse inflammation and sloughing of the scrotum, and even suppuration of the testicle, or phlebitis, pyæmia, and death, have been known to follow the operation. Pyæmic infection is, I believe, more likely to happen, when the veins are subjected to ligature; but by compression at two points, the intermediate portion of the veins is shut off, and thus excluded from any communication with the blood in circulation.

Excision of the veins, under antiseptic precautions, with catgut ligature of the divided vessels—has yielded safe and successful results.

Inflammation of the Testicle.—This subject comprises *Orchitis*, when the testicle itself is the seat of inflammation; and *Epididymitis*, when the epididymis is primarily affected. *Chronic* enlargement of the testis or of the epididymis, resulting from special causes of inflammation, may be Syphilitic or Scrofulous.

Orchitis and Epididymitis.—Inflammation of the Testis occurs less frequently than that of the Epididymis. But either part being primarily affected, the other becomes involved; and thus Orchitis and Epididymitis are often found associated.

SYMPTOMS.—Swelling arises, which has the characteristic shape of the part wherein the inflammation is seated; whether the *testis*, presenting a *smooth, ovoid* swelling; or the epididymis, when its inferior globus presents a nodular enlargement; or the whole of the *epididymis*, in the form of an *elongated mass* at the *back* of the organ, can be readily distinguished. As the swelling rapidly increases, it soon becomes tense and hard, especially in the testis, owing to the resistance of its more unyielding tunic; and it attains to a considerable size, that of an orange or even a small cocoa-nut. *Effusion* often takes place into the cavity of the tunica vaginalis, as well as into the substance of the gland, of the epididymis, or of both these structures; and thus the swelling may be exaggerated beyond what really pertains to the testicle. *Pain* accompanies the swelling, and it increases in severity proportionately to the tension of the part; with a sense of dragging weight, or a dull, heavy, aching, and sickening pain, extending up the cord into the groin, iliac region, and loins. The scrotum becomes tender, distended, and reddened, exhibiting also a congested state of the scrotal veins; as the integument and sub-cellular texture participate in the inflammation. Sharp inflammatory fever attends the development of the disease; and there is usually considerable nausea, or even vomiting and constipation, simulating strangulated hernia.

CAUSES.—Various *injuries* of the testicle, and sources of urethral irrita-

tion, may give rise to orchitis or epididymitis; and certain constitutional diseases have a predisposing influence, or may directly induce these inflammatory affections. Thus, exciting causes comprise: a blow, squeeze, or wound of the organ; external irritation, especially near the orifice of the seminal duct, as by gonorrhoea or other inflammation of the urethra, scabies, or the introduction of instruments; the impaction in, or the passage through, the urethra of a calculus; injury to the vas deferens in lithotomy or in puncture of the bladder per rectum. Prolonged sexual excitement may also be mentioned. The various sources of irritation in the urethra, or instances of injury to the seminal ducts, more commonly give rise to epididymitis than to orchitis; although the testis often becomes secondarily inflamed. Exposure to cold, as from sitting on a stone, may induce orchitis.

Of constitutional causes, mumps more frequently affects the testis than the epididymis, but the inflammation may commence in either part and extend to the other; syphilis, scrofula, gout, and rheumatism, especially gonorrhoeal rheumatism, may also severely predispose to, or induce, inflammation, either of the testis or of the epididymis. Excepting however syphilis, which chiefly affects the testis, the scrofulous, gouty, and rheumatic diatheses generally induce epididymitis, the testis becoming secondarily affected. Rarely, in the course of certain fevers, as small-pox or typhoid fever, the testes get inflamed. Children are liable to either acute or chronic orchitis, but inflammation of the epididymis is more common at an early age.

TERMINATIONS.—Acute inflammation of the testicle or of the epididymis usually subsides by resolution, in a period varying from a week to a fortnight or longer. Ultimately, when the structural condition of the organ is restored, its functional power remains unimpaired. Suppuration rarely occurs, though I have seen it in one case. Gangrene is even more uncommon; it is marked by the sudden cessation of pain, the scrotum becomes adherent and sloughs, with the tunica albuginea, exposing the gland-substance in the form of a dry, soft, yellow mass—unlike the appearance of ordinary gangrene. Atrophy is sometimes the result of inflammation, in consequence of mumps. Chronic enlargement of the testicle is a not uncommon result of long-continued orchitis, or of repeated attacks of inflammation. The gland-tissue sometimes undergoes calcareous degeneration; or the epididymis may be the seat of this transformation. But more often the degeneration is coincident with atrophy of the testicle.

TREATMENT.—In the acute stage.—Rest, in the recumbent position, with the testicle supported on a pillow or by a suspensory bandage, will allay the pain, and tend to subdue the swelling. In slight cases, no further treatment may be requisite. Suppressive measures, by means of cold lotions or the ice-bag, have little effect, but sedative applications, in the form of belladonna extract or the tobacco poultice, are in favour with some Surgeons. To preserve the structure of the testis, local blood-letting is a most effectual means of subduing the inflammation, whether as orchitis or epididymitis. Blood may be abstracted by the application of leeches to the scrotum, or by puncturing the congested scrotal veins. The latter method is preferable, as leech-bites are apt to become centres of inflammation. Puncturing is most conveniently commenced at the lower part of the scrotum, so that the blood trickling from the veins first

opened, shall not obscure the vessels above. Warm fomentations should then be applied, whereby double the quantity of blood may be drawn off than would otherwise be procured. Six or eight ounces of blood having been taken in this way, rest in the recumbent position, with the scrotum well supported by a pillow or handkerchief, will complete the local treatment in the acute stage of inflammation. It has been proposed to puncture the *tunica albuginea* at different points, in order to reduce the tension resulting from this fibrous tunic; and I have heard that great relief, and even a cure, has been thus speedily obtained in several instances. Constitutional treatment consists in the administration of antimonial saline aperients, combined with opium, hyoscyamus, or other sedatives. When, indeed, the inflammation follows gonorrhœa, hyoscyamus in full doses, with camphor mixture, will often prove sufficient to subdue the pain and swelling; unaided by any other medicinal agents.

Chronic enlargement, resulting from acute inflammation, is best reduced by strapping. Simple adhesive plaster may be used; or the emplastrum ammoniaci cum hydrargyro and soap-plaster, or mercurial ointment on strips of lint, under adhesive plaster; either of the two latter dressings affording both pressure and a stimulant application.

Chronic Enlargement of the Testicle, or Sarcocoele.—This condition of the Testicle may be the result of *simple* inflammation, having a traumatic origin; or it may be a manifestation of certain *constitutional* diseases—Syphilis or Scrofula. Thence, three varieties of Sarcocoele may be recognized, in regard to their *origin*. But the attempt to carry their distinction further has failed to establish any *essential* points of pathological difference;—in respect to the structural condition of the chronic enlargement, its signs or external characters with regard to diagnosis, and its terminations. The peculiar treatment requisite will, of course, depend upon the origin or cause of the Sarcocoele.

(1.) **Syphilitic Sarcocoele.**—In this variety of chronic enlargement of the *testicle*, the gland itself is chiefly affected, and less frequently the epididymis. It consists of a fibrinous deposit, *diffused*, or in the form of *gummy nodules*, situated in the *interstitial connective tissues* of the glandular structure in the septa, mediastinum, and tunica albuginea; and sometimes extending into the connective tissue of the epididymis. Thence, the organ becomes considerably enlarged, to the size of a turkey's egg, or perhaps of a coco-nut; it has an ovoid shape, is heavy, hard, and *nodulated*. But when the deposit is principally central, the organ may be smooth externally. Whenever the disease is limited to any part of the testis, the remaining healthy portion is sensitive to pressure, and the patient experiences a peculiar sensation when the organ is squeezed. An *effusion* of fluid sometimes takes place into the tunica vaginalis, constituting hydro-sarcocoele; a condition which *masks* the enlargement of the testicle, until the fluid is evacuated. There is little or *no pain*, only the inconvenience of the dragging weight. One, or not unfrequently both testicles, may be affected; though not in an equal degree, and more often in succession. The diagnosis, however, must be determined by the syphilitic history.

Syphilitic sarcocoele is one of the *later* manifestations or (secondary) symptoms of syphilis, occurring between the first and third year after chancre; although many years may have elapsed, or only four or five

months, in rare cases. Thus, this enlargement of the testis may be led with lrisle, tubercular syphilides, or with caries and necrosis of the bone.

Syphilitic epididymitis, apart from orchitis, is a rare form of the local affection, and which occurs at a much earlier period of the disease, in conjunction perhaps with the first syphilide, roseola. Thus, in *epididymitis* may date from the third or fourth month after infection. Both sides are more often affected. The *globus major* is the seat of induration, rather than the tail of the epididymis, as in common chronic inflammation; and the *globus* forms an enlarged and hard nodule, apart from the testis, instead of capping the organ. Spermatozoa may be found in the semen, even when the affection is double, which can scarcely happen were the single tube in the tail impervious to the transmission of seminal fluid. Lastly, there will be the history, and usually some other concomitant local manifestations of syphilis. This *painless epididymitis* never suppurates, but slowly subsides.

The CONSEQUENCES of this enlargement are: *atrophy* of the glandular structure, owing apparently to contraction of the interstitial fibrous deposit; as in cirrhosis of the liver; *suppuration* may take place, forming an abscess in the substance of the testicle. The *gummy* pus may degenerate into a caseous, calcareous, or earthy mass; but usually the abscess, increasing, at length contracts adhesion with the tunica vaginalis and scrotal integument, and then bursts through the tunica albuginea and discharges externally. The aperture having continued for a time, closes permanently; or a succession of abscesses form, burst, and heal. Any such abscess of the testicle, having burst, is not unfrequently followed by ulcerative enlargement of the aperture, and protrusion of a portion or whole of the organ,—forming *hernia testis*. The integument, thickened and indurated, constricts the protruded portion; and granulations springing up, give an expanded appearance to the protrusion, beyond what is really testicular.

TREATMENT.—When syphilitic sarcocele has not been long established, absorption of the deposit may be somewhat promoted by means of medicinal agents; and the glandular tissues of the testis being thus relieved from the intra-tubular compression, before it has become atrophied, the organ resumes its function. A mercurial course, combined with tincture, often proves beneficial; the bichloride of mercury, in doses of the twelfth or eightieth of a grain, with quinine, three times a day, and continued for six or eight weeks. Iodide of potassium may then be advantageously substituted, until the hardness and swelling disappear. Supporting the testicle, as already explained, with adhesive or mercurial plaster, is less effectual in promoting absorption; and sometimes it seems to arrest the latest deposit to suppuration.

(2.) *Sarcoides and Tubercular Sarcocele*.—This variety of chronic enlargement of the testicle differs only from that of syphilitic origin, in two particulars: generally the epididymis, and even the vas deferens,—sometimes, however, the testis,—is primarily the seat of sarcooidous deposit. This yellow, caseous material is at first contained within the tubule, in most cases; although an extra-tubular formation, from cell-proliferation, would seem to be indicated by the observation of Rindfleisch and other excellent pathologists. The cellular form of enlargement is usually present; and as the testicle itself soon becomes

implicated, the whole organ is enlarged and irregular, heavy and indurated, at an early period of the disease. Tubercular deposit, in the form of grey, semi-transparent, granular tubercles—as found in the lungs—may represent the kind of deposit in the enlarged testicle; thence named *tuberculous sarcocoele* (Fig. 157). *Hydrocele* sometimes ensues, *disguising* the testicular enlargement, until the fluid is evacuated. Generally one testicle only is affected, though both may be involved.

The almost *painless* character of the disease, as in syphilitic sarcocoele, reduces the **DIAGNOSIS** of these two varieties of sarcocoele to the external characters of the enlarged testis; and as these are not positively distinctive, the nature of the disease can only be determined by the *co-existence* of other scrofulous affections or tendencies. Thus, the condition of the lungs should be examined, and that of the prostate and seminal vesicles; the latter parts being not unfrequently also enlarged by scrofulous deposit. This disease of the testis is incident to early adult life, or to childhood.

The **CONSEQUENCES** of scrofulous sarcocoele are not peculiar; but the tendency to suppuration and *abscess*, followed by *hernia testis*, is even more marked than in syphilitic sarcocoele. There is also abscess in the *epididymis*, extending up the vas deferens, and converting their hardened enlargement in a fluctuating bag of pus.

TREATMENT.—*Constitutional* and hygienic measures are more likely to prove beneficial than any local treatment. Tonics, principally iron or the iodide of iron and quinine, with cod-liver oil, should be taken for a considerable period; the diet must be well regulated, and other means adopted for the improvement of the general health. At the same time, the iodide of lead ointment, and *strapping* the testicle, may have some locally curative influence of subordinate importance.

Abscess in the Testicle, as the result of inflammation of this organ, occurs sometimes from syphilitic orchitis, but more commonly from scrofulous orchitis. Having burst, in a few days or weeks—according to the acute or chronic character of the abscess—the swelling of the testis subsides, and atrophy of the gland-tissue results, with a fistulous opening, which may continue for years. The **SIGNS** of abscess are in no way peculiar, and the **TREATMENT** must be conducted on ordinary principles. Sometimes, *central* suppuration takes place, and the abscess is very *chronic*; it may never burst, but the matter slowly undergoes caseous and cretaceous transformation; while the enclosing testis becomes indurated and atrophied. The organ remains tender or painful, and is subject to repeated attacks of subacute inflammation.

Hernia Testis, or protrusion of the testicle, is apt to follow the bursting of an abscess. The appearances have been already noticed. It

FIG. 157.*



* London Hosp. Mus.

growth, usually a red, granular, fleshy mass, but varying according to the mode of inflammation, sloughing, or granulation. The mass becomes expanded over, and is restricted by the margin of the aperture in the original tissue albuginea, tunic vaginalis, and indurated areolar integument (Fig. 138).

Treatment.—According to the size of the protrusion, the attempt may be made to reduce it, or it will be necessary to remove the mass. When of small size, a cure may often be effected by pressure; when not

FIG. 138.*



or deeply spread with the contents of red cells of pus, a small incision is made upon the protrusion, and well stretched down with strips of plaster. Or, the integument may be detached on either side of the protrusion, the edges pared, and brought over it in front, and retained by sutures; pressure being then applied. Another plan consists in drawing down to the tunica albuginea, and then binding the margin of the aperture in that point, like the ring in strangulated hernia. After this, the treatment is said to be much more successful.

When either of these plans be failed, or the protrusion is of larger size, it should be removed by sloughing it off with a bistoury. No attempt should ever be made to pull away

the external portion of testis, but the remainder of the gland-crease to the ducts cut. During the process of granulation, the tendency to contraction will sometimes should be opposed by drawing with the external contract, and wrapping.

If nearly the whole organ be protruded, or the portion left by accident be too diseased, it will be better to have recourse to excision. The external portion of testis would be of no functional use, and would weigh away, prejudicing the rest.

When, consequent to inflammation, of the spermatic cord, often so granular; but with a surrounding syphilitic lesion,—which I have not yet seen—it will be with difficulty to manage the complication which the testis presents. A cure cannot be hoped, and the limited protrusion may be removed whenever it becomes

* From the Hospital. (Richter.)

Tumours.—The testicle, like other organs, is liable to be the seat of various morbid growths, forming Tumours: Cystic; occasionally, Cartilaginous and Fibrous; or Cancer,—Encephaloid and Scirrhus.

(1.) **Cystic Sarcoma of the Testicle.**—This form of Tumour may be purely Cystic; or associated with Cartilaginous or with Cancer Growth.

Cystic Disease consists of an agglomeration of cysts, thin-walled, varying in size from a pin's head to a walnut, and their globular shape modified by mutual pressure. They are *simple* cysts; containing fluid, thin and colourless, or viscid and blood-tinged or otherwise discoloured; or they become *proliferous*, bearing on their interior fibrous growths, of a pedunculated and lobulated shape, which occupy and eventually distend the cysts.

The growth is not generally diffused throughout the organ,—it originates, and remains circumscribed, in one part; and as the growth increases, the unaffected portion of the testicle is pressed aside or spread out over the tumour; so that the mass, which is usually spherical, can perhaps be shelled out, leaving a considerable part of the testicle healthy. Occasionally, gland-tissue has been found dispersed to a certain amount through the cystic tumour; but as it atrophies from pressure of the interposed cyst-formation, little or no trace of the healthy structure of the testis may remain. The *epididymis*, at first unaffected, becomes flattened, compressed, and atrophied; while the surfaces of the tunica vaginalis becoming perhaps adherent, the cavity is more or less entirely obliterated. Spermatozoa are never found in the cysts. Hydrocele seldom co-exists with cystic testicle. One organ only is affected with the disease.

SIGNS AND DIAGNOSIS.—The testicle enlarges, acquires an oval or nearly spherical form, and slowly attains to a considerable size. Its *weight* is less than that of any solid tumour, but it is heavier than hydrocele. Elasticity, over a *limited area*, with less decided fluctuation, and a total absence of transparency, will chiefly distinguish cystic testicle from *hydrocele*. The *painless* character of the tumour, and absence of constitutional symptoms, with the *slow* rate of *growth*, may determine the diagnosis with regard to *encephaloid cancer* of the testicle. But the distinction between cystic growth and *non-transparent hydrocele*, *hæmatocele*, and cancer, cannot sometimes be arrived at with certainty, except by the aid of *puncture* to examine the nature of the fluid yielded, and at several points of the tumour. Cystic testicle is most frequent between twenty and fifty.

No particular **CAUSE** can be assigned for the production of this disease, otherwise than it seems occasionally to be consequent on injury to the testicle, as a blow or squeeze.

TREATMENT.—Castration is the only cure; and it may be resorted to at an early period, especially when the other testicle is healthy and functionally efficient. As in the case of other double organs, the remaining testicle will probably acquire the power of doing double duty. The disease never returns, a therapeutically important distinction as compared with Cancer.

CARTILAGINOUS GROWTH, or ENCHONDROMA, is often associated with Cystic Tumour. The cartilage usually exists in the form of nodules, set in a fibrous matrix, or which grow from and occupy the interior of the

cysts; as a cartilaginous variety of proliferous cysts. These nodules are sometimes strung together into lines; as if the cysts had formed by accumulated dilatations of the seminal tubes of the testis or its non, in accordance with Curling's interpretation of cystic testicle. The cartilaginous structure may undergo calcification or ossification.

This structural admixture of cartilage, or of its transformation, with cysts, modifies the signs of cystic tumour of the testicle, by giving hardness and weight to the mass. But any such complication in no way contra-indicates the treatment by castration, nor affects the success of its results.

CANCER-GROWTH is not unfrequently associated with Cystic Tumour; this growth also taking place from the interior of the cysts, as a cancerous variety of proliferous cysts. The kind of cancer is *encephaloid*, and it forms in some parts of the tumour, leaving the remainder simply cystic; but ultimately perhaps invading the whole mass.

The Signs of cystic testicle are modified accordingly; and although the treatment must still be castration, yet the result of the operation, as to a return of the disease, will be uncertain.

DERMOID CYSTS, of congenital origin, have unquestionably been met with in some instances; the cysts containing sebaceous matter, hair, teeth, and other foetal constituents, located in the testis or the scrotum. The cyst may grow slowly, but at last rapidly attains to a large size, while the testis becomes atrophied.

The tumour presented by any of these abnormal cyst-formations will necessarily be of a doubtful character, even when examined by an exploratory puncture. Sometimes, inflammation and abscess supervening, the contents of the cyst are discharged, and their nature thus declared. But this may not occur until after a period too late for the purpose of diagnosis; a dermoid cyst perhaps growing from birth for some years as an *indolent* tumour. The congenital formation of the tumour will be characteristic; and in an *infant*, the presence of a scrotal tumour from birth may thus be distinguished from tubercular sarcocele and encephaloid cancer of the testis, which are the only affections of this organ that may probably occur at an early period of life.

Castration always reveals the nature of the case, while it affords the only remedy.

(2.) **Fibrous Tumour of the Testicle** is generally enumerated among the Tumours to which this organ is liable. An apparently well-marked specimen is described by Cruveilhier. Its consistence was very firm, and it creaked under the scalpel; the weight of the tumour was heavy in comparison with its size, which was twice that of the natural size of the testicle. In point of structure, when examined, it was found to consist of contorted and interlaced greyish-white fibres, forming lobules, with vessels penetrating their interspaces; thus certainly confirming the nature of this tumour. Sir James Paget speaks of a "fibro-cellular tumour," removed in like manner by Mr. John Lawrence; and which was so succulent that, in its consistence, it resembled a fatty tumour.

SIGNS.—The enlarged testicle has a uniform shape, and the tumour is solid, very hard and heavy, painless, and of slow growth.

Castration is not followed by recurrence of the growth.

(3.) **Cancer of the Testicle** usually appears in the form of *encephaloid*.

loid, or occasionally its *melanotic* variety; rarely in the form of *scirrhus*. *Colloid* is said to have occurred; and *epithelial* cancer, having originated in the scrotum, has been known to invade the testicle, as an extension of the disease, though not to appear primarily in this organ.

ENCEPHALOID cancer commences generally in the glandular portion, as small masses among the tubuli seminiferi; and these increasing, coalesce, to the destruction of the glandular substance. Less frequently, it begins at one point in the centre of the testis, or in the rete; occasionally, in the epididymis; and rarely, in the tunica vaginalis. From either of these sources the growth invades the whole organ, reducing it to a cancerous mass, without any trace of the natural structure. It is very unusual to find both organs affected. Death ensues; usually, in about eighteen months or two years.

SIGNS.—Enlargement of the testicle, as a *solid, heavy tumour*, of *rapid* growth, is the almost infallible indication of Encephaloid cancer. The unbroken tunica albuginea gives a hardness uniformly over the tumour, and a smoothness of surface, which really does not belong to encephaloid cancer; for these early characters cease subsequently, as the mass *softens* at parts into an *elastic, pulpy, semi-fluctuating* tumour, and which losing its ovoid shape, becomes *irregular*, or when the tunic is ruptured and the mass *protrudes*. Before this occurs, the scrotum is traversed by large veins, and has grown adherent to some prominent portion of the tumour; these changes being followed by ulceration, and fungoid protrusion. Then the whole tumour appears much larger, and rapidly grows to a considerable size. There is commonly little tenderness or pain; or if there be, it is aching, with acute, lancinating, or burning paroxysms. When the cord has become involved, it is enlarged, and feels thickened and full; so that the vas deferens cannot be distinguished. Shooting pains extend along the cord to the groin and loins. As the disease advances, the *lumbar glands* become involved, secondary cancer also being developed in other organs. Constitutional symptoms are evinced by cachexia, and a breaking down of the general health, partly from repeated hæmorrhage; the patient having been at an early period of the disease often in a robust, fleshy, and florid condition of health. The age when cancer of the testicle most commonly appears is from twenty to forty; it is rare after sixty, but it may be met with at any period of life, from the earliest infancy to old age.

The DIAGNOSIS from other tumours of the testicle is mainly determined by the *solidity* and *weight* of Cancer Tumour, with its *rapid growth*; but it must be distinguished from acute orchitis, and from chronic enlargement of the testicle,—syphilitic or scrofulous. The symptoms of *inflammation*, or the *constitutional* condition, respectively exclude these *Swellings* of the testicle from the question of diagnosis; and the various forms of Tumour are severally excluded by reference to the above-named characters. Thus, Cancer Tumour of the testicle differs from *Cystic* Tumour in all these particulars,—its solidity, weight, and rapidity of growth; from *Fibrous* Tumour, if such should occur, it differs in the far greater rapidity of growth; and from *Cartilaginous* Tumour, the difference in this respect is equally significant. As compared with *non-transparent Hydrocele*, and with *Hæmatocoele*, respectively, the solidity and weight of Cancer Tumour are distinctive. But often the diagnosis can be accurately

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Department of Labor on the Technical.—General note: provided that the results of the Census are to be used accurately, then the Census is entirely self-sufficient in the operation and is performed, and with several small alterations, it would be of use in other parts. What, however, is involved, and perhaps also the further growth, is more or less immaterial to the Census, and, as such, will

The results of the operation have been described in detail at a special conference of the Society. When asked, he has emphatically affirmed the validity of a preliminary test of the lungs, a remarkably strong and clear-cut test for a short period. On the other hand, emergency drainage by operation, although not new in itself, has been a radical source of infection. Mr. Gilling pointed out the patients were well at the negative periods of respiration, even during the operation.

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The *spermatic artery*, and probably two or three cremasteric branches, will require ligature. This mode of securing the vessels is preferable to tying the whole cord, a practice adopted by some Surgeons. To prevent retraction of the cord through the ring in the inguinal canal, it should be *transfixed* with a ligature, and retained in position by a strip of plaster over the ends of the thread. Scrotal vessels generally cease to bleed by sponging with cold water. The edges of the scrotal integument are brought together with sutures, and a drainage-tube inserted.

If *hernia* co-exists with disease of the testicle, the peritoneal sac must be carefully avoided in performing this operation; the handle of the knife being used to separate any adhesion in removing the organ.

Hyperæsthesia of the Testicle.—Under the name of Irritable Testicle, an exalted sensibility of this organ sometimes occurs, which may be more correctly designated hyperæsthesia. The testis is so abnormally sensitive as to be always tender and uneasy, and the slightest touch, pressure, or friction, provokes pain, which may soon become intolerable. The sensation is more distressing when the person stands, and the organ hangs down; and then being unable to bear the mere contact of trousers, or rubbing from the slightest exercise, he is precluded from the active business or pleasures of life. Sometimes the pain is referred to some one spot, particularly the head of the epididymis, rather than experienced in the whole gland; and it may extend up the spermatic cord into the abdomen, so that pressure from any distension of the colon aggravates the suffering. The testicle, thus affected, undergoes no apparent alteration of size, shape, or consistence; although occasionally it seems to be somewhat fuller, with a tendency to varicocele in the cord, and a relaxed state of the scrotum. The left testicle is more often affected, and in some cases both organs are abnormally sensitive.

This painful affection of the testicle is met with usually in persons of the leuco-phlegmatic or the nervous temperaments, accompanied with an anæmic condition and feeble circulation; or in those of a melancholic predisposition, and attended with dyspeptic symptoms. By constantly brooding over their complaint, the suffering grows more severe and uninterrupted, which may cease for a while, when the attention is preoccupied. On inquiring into the *habits* of the unhappy patient, hyperæsthesia of the testis may be traced to immoderate sexual excitement, or to self-abuse; and, in youth, it is not unfrequently owing to the latter pernicious habit from the time of puberty, when the functional activity of the gland begins with tenderness in the organ. Not unfrequently, however, the history is that of a perfectly chaste life, with the restraint of sexual desire; in monks, old bachelors, and widowers. In some cases, this affection is con-

FIG. 159.



having regard to the urgency of the patient's request when the nature of the case is explained to him, in an intermission of pain.

Malposition of the Testicle.—In the fœtus, the testes are contained within the abdomen, in the lumbar region; whence they gradually descend through the inguinal canal into the scrotum, a change of situation which is usually completed before birth. But, by an arrest of development, this descent of the testis may be retarded until after birth, and it may then never take place completely. The descent of this organ is delayed till a few months, or a year, after birth, in about one infant in five; occurring at a later period, the testis may descend at from one to seventeen years, or even twenty-one years. Complete descent fails to take place in about one person in 1000; and then the testis may be permanently retained in the *abdomen*, or in the *internal abdominal ring*, in the *inguinal canal* just above the external abdominal ring, or perhaps just *below* the *ring*. The right or the left testis is nearly equally liable to these malpositions, the latter being more often displaced; and very rarely it happens with both testicles. Usually, only one testis being retained, the state is known as *monorchidism*; when the scrotum is empty on both sides, it is designated *cryptorchidism*. Sometimes, the imperfect descent at birth is *completed* in a few weeks, or before puberty.

The condition of the retained testis, as to its *structure* and *function*, is variable. An imperfect and incompetent state of the testicle is more frequent when the organ is retained in the inguinal canal, than in the abdomen, where the gland is protected from injury and the spasmodic compression of the abdominal muscles. This want of secretory power for the production of spermatozoa, is of little consequence when the other testicle has descended and is healthy; the one organ being quite sufficient for generation. But when *both* organs are retained, the procreative power will usually be completely wanting; the individual is absolutely impotent. He may have full sexual desire, power of erection, and emissions during connection; but the spurious seminal fluid contains no spermatozoa, and has no impregnating influence.

Hernia is apt to *co-exist* with malposition of the testis; when the organ fails to descend within a *year* after birth, its subsequent evolution generally entails a hernial protrusion. When lodged in the inguinal canal, the testicle is enveloped by a peritoneal sac, prolonged from the abdomen, admitting a protrusion of bowel, and which may be adherent to the testis; but in some cases, this communication having become closed, the testicle is isolated in a *distinct sac*, and thus the retained organ can only be complicated by a *separate* inguinal hernia,—the other and more common complication being *congenital* hernia. The same distinction holds good in regard to the possible conjunction of *hydrocele* with retained testis in the inguinal canal,—forming the non-congenital and congenital conditions of inguinal hydrocele.

TREATMENT.—The treatment of arrested descent of the testicle should be guided by the *situation* of the organ, and the *age* of the patient; and also by the not uncommon co-existence of *inguinal hernia*. 1. When the testicle is retained in the *abdomen*, its complete descent can rarely be expected after the first year; at any *later* period, therefore, the organ had better be kept up,—out of the way of injury, and to prevent the liability to hernia. Accordingly, a properly fitting *truss* may be applied and worn

with advantage. 2. If a hernial protrusion has already taken place, it would be desirable to give a fair chance for the descent of the testicle; but after the lapse of *two years* from birth, it will be more advantageous to prevent the *recurrence* of hernia with its risks, than to wait for the far less probable passage of the testis. Even although the organ may have already passed into the *inguinal canal*, if it can be returned, the same treatment should be adopted; but when the testis has emerged just *through* the *external ring*, a truss may be applied to keep up the hernia, and thus also preclude the return of the organ into the canal. *Disease* of the testis in the inguinal canal is amenable to excision; and in the event of an operation for strangulated hernia, opportunity may be taken to remove the retained organ in an adult, as a useless and often troublesome abortion.

Retraction of the Testicle must not be confounded with retention of this organ. The one is an *acquired*, the other a congenital, malposition. A retracted testis generally lies just *outside* the *external abdominal ring*; but it may be higher up—within the inguinal canal, or drawn into the abdomen. This affection may occur on both sides; and it is more common in children than in adults. It is caused by *spasmodic* action of the cremaster muscle, owing to the connection of the spermatic and renal plexuses of the sympathetic nerves. Usually, the spasmodic retraction is *temporary*—coming on, and ceasing suddenly; but sometimes the affection continues for hours, or may even be *permanent*. It depends on some source of *irritation* in the urinary organs; disease of the kidney, the transition of a renal calculus through the ureter, morbid states of the urine, contusion over the pubes, a prostatic or urethral calculus. In old-standing cases, the scrotum becomes atrophied; and thus permanent retraction may be mistaken for congenital retention, unless the previous descent of the testis can be positively ascertained. The retracted testis is liable to injury and the same diseases as in retention; and after a while, the organ will probably have become degenerated and functionally useless.

TREATMENT must be directed to the cause of retraction; but often the testicle may be replaced in the scrotum by gentle traction downwards, and then the application of a light-bearing *truss* will suffice to preclude its return. A permanent cure may thus be effected in two or three months.

Diseases of Retained Testicle.—The organ is liable to *hydrocele*, *inflammation*, and *malignant disease*, *encephaloid* cancer more particularly; and orchitis is especially apt to occur when the testis is lodged in the inguinal canal, the inflammation arising from gonorrhœa or from injury.

The DIAGNOSIS between a retained testis in that situation, and inguinal hernia, or even bubo, must be decided by reference to the symptoms of these conditions. The *absence* of impulse on coughing, and of the testicle from the scrotum, are the chief differential characters—with regard to a hernial protrusion. Mistakes have been made by eminent Surgeons, between *inflammation* of the testis and *strangulated hernia*, in the inguinal region; and Ricord nearly mistook an inflamed testis for a bubo. *Congenital hernia*, as already noticed, not unfrequently accompanies and complicates undescended testis in the inguinal canal. The testis may be unable to bear the pressure of the *truss* requisite to prevent the descent of the hernia; while in an operation some difficulty is often experienced, owing to adhesion of the gland and bowel.

Mis-descent of the testicle sometimes takes place; the organ having descended within the abdomen, it escapes into the *perinæum* near the anus, or into the pelvis; or through the *crural ring* and saphenous opening, thence upwards upon the abdomen, so as to simulate crural hernia, or is lodged behind the fascia in the upper and inner part of the thigh. In either situation, the *tumour* might be mistaken for hernia—crural, or far more rarely, perineal; and *inflammation* of the misplaced testis would simulate hernial strangulation. But the absence of impulse on coughing, and of the testis from the scrotum, are diagnostic.

DISEASES OF THE VESICULÆ SEMINALES.

The Seminal Vesicles are not uncommonly diseased in company with the testicles, or sometimes independently of those organs; and these diseases may induce or aggravate disease of the bladder, and less frequently, of the rectum.

The seminal vesicles are subject to **INFLAMMATION**, arising independently or in consequence of gonorrhœa; and they are liable to **CHRONIC ENLARGEMENT**, especially of a scrofulous character, and to **MALIGNANT DISEASE**.

Certain **SYMPTOMS** are common to these affections. Pain of an acute character, or an aching sensation, is experienced low down, towards the perinæum, and passing up to the sacrum. This is much aggravated during micturition or defæcation; and although there may be frequent erections, with painful distension of the penis, sexual intercourse is intolerable, the emission of *semen* being mingled with *pus* and *blood*. Involuntary nocturnal discharges further distress the sufferer. Sometimes, a urethral oozing of a viscid, purulent, and blood-stained matter affords relief. The testes are somewhat full and tender. *Abscess* often results from acute inflammation, and bursting into the urethra or rectum, may form a fistulous communication. *Chronic thickening* may obliterate the vesicle, and lead to wasting of the vas deferens and testicle. *Scrofulous* or tubercular enlargement is apt to undergo caseous and calcareous degeneration into an indolent mass, or the softening of caseous matter results in abscess. *Cancerous* disease of the vesicles is attended with pain and other symptoms which might arise from inflammatory swelling, but the discharge, containing cancer-elements, may be distinctive.

DIAGNOSIS is much facilitated by the situation of these bodies, as they lie within reach of the finger passed into the rectum.

TREATMENT must be conducted on ordinary principles. Abscess should be opened early, per rectum.



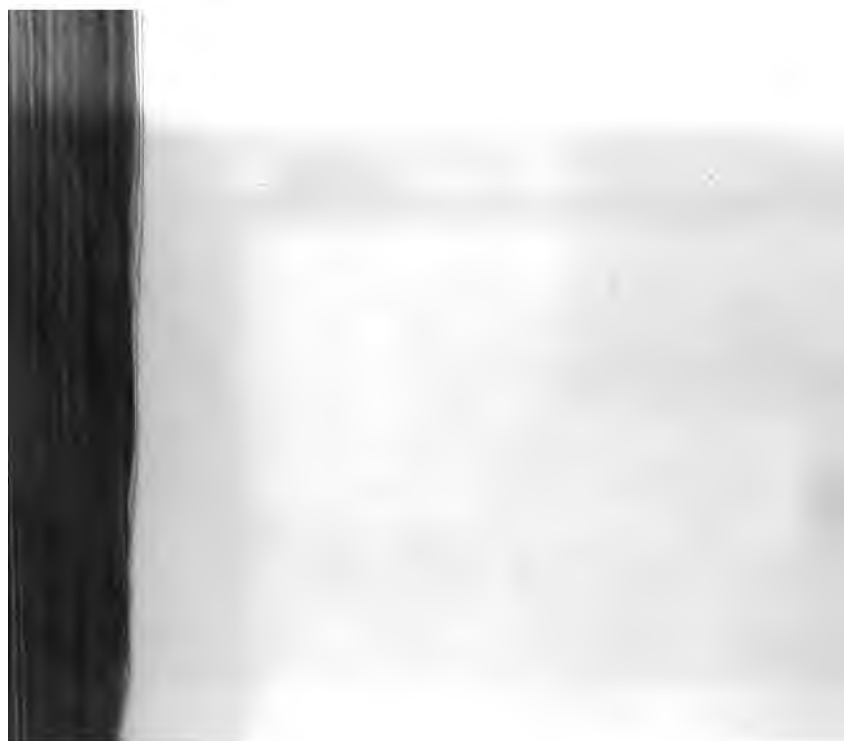


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